

Moose Management Report of Survey-Inventory Activities 1 July 2001–30 June 2003

**Cathy Brown, Editor
Alaska Department of Fish and Game
Division of Wildlife Conservation
December 2004**



Photo by Randy Rogers, ADF&G

Please note that population and harvest data in this report are estimates and may be refined at a later date.

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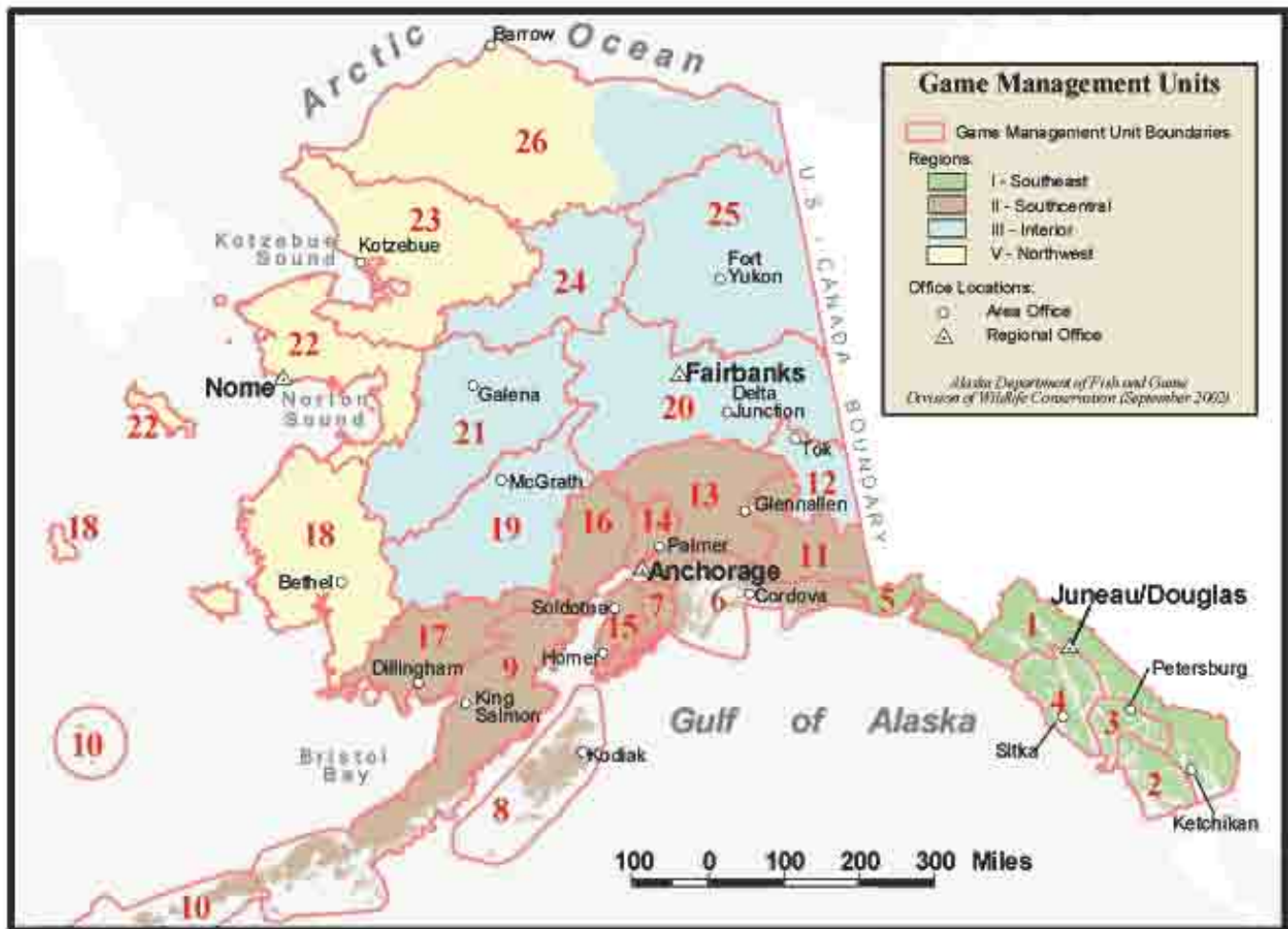
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MOOSE MANAGEMENT REPORT

From: 1 July 2001

To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: Unit 6 (10,140 mi²)

GEOGRAPHIC DESCRIPTION: Prince William Sound and North Gulf Coast

BACKGROUND

Moose populations in most of Unit 6 originated from translocations of calves from the Kenai Peninsula, Anchorage, and Matanuska-Susitna area (Burris & McKnight 1973). During 1949–1958, Cordova residents successfully raised 24 captive moose calves and released them on the western Copper River Delta in Subunit 6C. This small population grew rapidly and expanded eastward into Subunit 6B by the early 1960s. Eastward expansion continued into Subunit 6A to the Bering River area by the late 1960s, and to Cape Yakataga by the mid 1970s. The population reached a record high of approximately 1600 in 1988 (Griese 1990), then declined to about 1227 by 1994 as part of a planned reduction (Nowlin 1998). The only moose endemic to Unit 6 are small populations in the Lowe River drainage and Kings Bay in Subunit 6D, numbering about 40 animals total.

Hunting of the introduced population in 6C began with 25 bulls harvested in 1960. Harvest began in 6B and 6A during 1965 and 1971, respectively. Moose in 6A were divided into 2 populations (east and west of Suckling Hills) during 1977 and have been managed separately since then. Hunters have harvested approximately 3800 moose during 1965–1998 in Subunits 6A, 6B and 6C. In contrast, total kill of the endemic moose population in 6D during the same period was approximately 40 moose. The harvest quota for cow moose in Subunit 6C was commandeered into federal subsistence during 2000–01, followed by 75% of the bull harvest quota during 2002–03.

Population objectives were relatively conservative in the 1970s and early 1980s because of concern about mortality during severe winters. Objectives were established at 0.9–1.2 moose/mi² after a severe winter in 1971–72 and remained conservative under management plans written in 1976 (Rausch 1977). Nowlin (1995) revised objectives in 1994 using new information about carrying capacity of the winter ranges (MacCracken 1992) and refined estimates of population size.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

Our goals in Subunit 6A (East) are to take large moose and to provide for optimum harvest. For the remainder of Unit 6 the goals are to provide for optimum harvest and to provide for the greatest opportunity to hunt.

POSTHUNT MANAGEMENT OBJECTIVES

Our management objective for Subunit 6A (East) is to maintain a population of 300–350 moose and a minimum bull:cow ratio of 30:100. Our objectives for Subunit 6A (West) and 6B are to maintain populations of 300–350 moose and minimum bull:cow ratios of 15:100 in each unit. In 6C our objective is to increase the population to 400 moose by the year 2006 and maintain a minimum bull:cow ratio of 15:100.

METHODS

We conducted modified (Gasaway et al. 1986) censuses to estimate moose population size and composition. We used Piper Super Cub (PA-18) and Bellanca Scout aircraft for searches of sample units. Estimates of sex and age ratio were derived only from censuses conducted before mid December. Population estimates were not corrected for sightability. Corrections calculated during previous censuses indicated we observed >89% of the moose present (Nowlin 1998).

Sample units for aerial censuses cover all moose habitat in Subunits 6A–6C. Viereck et al. (1986) described the habitat types present, and MacCracken (1992) identified types that were most important for moose. These habitat types were below 500 feet elevation in river valleys and deltas of the coastal plain and included open tall-willow (*Salix sp.*), closed tall alder-willow (*Alnus sinuata-Salix sp.*), low sweetgale-willow (*Myrica gale-Salix sp.*), woodland spruce (*Picea sitkensis*) and aquatic (wet forb-herbaceous) (Nowlin 1995).

Hunters participating in drawing or registration permit hunts were required to report. Those who failed to report were telephoned and sent no more than 2 reminder letters. Hunters participating in general moose hunts were sent a reminder letter if they failed to return their hunt report.

We summarized census and harvest data by subunit, except for 6A, which was divided into eastern and western portions. The eastern portion was all drainages into the Gulf of Alaska between Cape Suckling and the head of Icy Bay. The western portion was all drainages into the Gulf between Cape Suckling and Palm Point.

We began a cooperative study funded by the U.S. Forest Service, Cordova Ranger District to monitor moose habitat of the western Copper River Delta (CRD) in Subunit 6C. Moose habitat on the CRD is dynamic, with some areas entering into unproductive seral stages and others supporting new growth. Hence, rather than trying to measure carrying capacity based on habitat, we examined nutritional status of moose based on rump fat thickness, which had a strong linear relationship ($r^2=0.96$, $p=0.0001$) with total body fat of pen-reared moose (Stephenson et al. 1998). A total of 12 cows were captured (half with calves) and collared during November and again in March. Rump fat thickness was measured using ultrasonography.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Lack of snow, storms and high winds limit moose censuses almost annually in Unit 6. However, unusually good conditions during February 2002 allowed the completion of censuses for all 4 moose populations in Unit 6 (Table 1). Poor conditions precluded moose surveys during regulatory year (RY) 2002–03.

POPULATION SIZE

The posthunt moose population in Unit 6 during 2001–02 was approximately 1200 moose, including 280 in 6A (East), 300 in 6A (West), 200 in 6B, 340 in 6C, and 50 in 6D. Censuses indicated the moose population in 6C stabilized at about 350 during the last several years, despite the conservative harvest (Table 1). Subunit 6B decreased because of continued low productivity and heavy predation. I suspect a high, but as yet unquantified, bull:cow ratio has limited the productivity of moose populations in 6C and 6B. Moose in 6A (West) also declined from the last survey. Subunit 6A (East) moose were stable.

POPULATION COMPOSITION

Aerial surveys indicated the proportion of calves in 6A (West) and 6A (East) was 13% and 15%, respectively (Table 1). In 6B declining population and calf survival has prompted conservative bull harvests and no antlerless hunts since 1996. The proportion of calves in 6C was 20% during February 2002, following a record low during the last reporting period. Low calf survival has occurred every 4–6 years in 6C, followed by a rebound. No estimates of bull:cow ratios were obtained because bulls had shed antlers when we conducted the censuses.

MORTALITY

HARVEST

Season and Bag Limit. In Subunit 6A (East), the bag limit for all hunters was one moose. The bull moose season during this reporting period was 1 Sep–31 Oct. Nonresident hunters were restricted to bulls with 50-inch antlers or antlers with 3 or more brow tines on at least 1 side. Resident hunters were restricted to spike, fork or 50-inch antlers.

In Subunit 6A (West), the season for all hunters was 1 Sep–31 Oct, with a bag limit of one moose. Residents were allowed to take up to 20 bulls by registration permit, and nonresidents were allowed to take up to 5 bulls by drawing permit. We established an annual allowable harvest for bulls that included both hunts. When that harvest limit was reached, both hunts were closed by emergency order.

The season in Subunit 6B was 27 Aug–31 Oct, during the reporting period for resident hunters only with a bag limit of one moose. We authorized a harvest of 12 bulls by registration permit. No motorized vehicles were allowed for transportation 15–31 August, with the exception of highway vehicles on the maintained surface of the Copper River Highway. Also, moose could not be taken until after 3 a.m. following the day on which an

airboat was used for transportation. All airboats were required to display an ADF&G identification number.

In Subunit 6C the season was for resident hunters only 1 Sep–31 Oct, with a bag limit of one moose by drawing permit. Up to 25 drawing permits were authorized, 20 for bulls and 5 for antlerless moose. Beginning in 2000–01 the 5 antlerless moose permits were administered as a federal subsistence hunt by the U.S. Forest Service, Cordova Ranger District, followed by 75% of the bull quota in 2002–03.

The general season in Subunit 6D for all hunters was 1–30 Sep, and the bag limit was one bull by harvest ticket.

Reported moose harvest for Unit 6 was 84 in 2001–02 and 72 in 2002–03 (Table 2). We kept harvest low in Subunit 6B because of continued poor calf survival, and in 6C to allow a population increase (Nowlin 1998).

Composition of the moose harvest in Unit 6 was 89% males during 2001–02 and 88% in 2002–03. Those numbers were in the normal range.

Board of Game Actions and Emergency Orders. We issued emergency orders to close the registration permit hunts for bull moose in 6B (8 Sep and 4 Sep, respectively), and 6A (West) (7 Oct in 2001). These were normal management actions. The Board of Game reauthorized antlerless moose hunts, and increased season length by one month (to 30 Nov) in 6A–6C during the March 2003 meeting.

Permit Hunts. During this reporting period, Subunit 6A (West) had 1 registration and 1 drawing permit hunt, 6B had 1 registration hunt, and 6C had 2 drawing hunts (Table 3).

Hunter Residency and Success. Local residents composed 69% of all moose hunters in Unit 6 during the reporting period (Table 4). Conservative and resident-only seasons discouraged nonlocal hunters from participating.

Harvest Chronology. Most of the Unit 6 harvest over the past 2 years occurred during September (Table 5). The harvest pattern has not changed over the past 5 years.

Transport Methods. Boats, primarily airboats, were the most commonly used transport method during this reporting period (Table 6). Airplanes and highway vehicles followed them in decreasing order of importance. This pattern of use has not changed over the past 5 years.

OTHER MORTALITY

Predation by brown bears and wolves was the primary cause of calf mortality. Brown bears and wolves were observed feeding on neonatal and adult moose in various parts of the unit (Carnes et al. 1996, MacCracken et al. 1997, personal observation). Brown bear populations increased in Subunits 6A, 6B, and 6C during the 1990s (Crowley 2000). Conservative estimates of moose kill rates for wolves in Unit 6 (Carnes et al. 1996) indicate at least one-quarter of the Subunit 6B population could be killed by wolves each year.

CONCLUSIONS AND RECOMMENDATIONS

Moose populations were below management objectives in all areas, primarily because of predation. We could not evaluate our objectives for bull:cow ratios because we completed no censuses before mid December when a significant number of bulls have dropped their antlers. High bull:cow ratios have become evident in Subunits 6B and 6C; therefore, more emphasis will be placed on obtaining these estimates in early winter rather than waiting for adequate census conditions during midwinter.

LITERATURE CITED

- BURRIS O. E., AND D. E. MCKNIGHT. 1973. Game transplants in Alaska. Technical Bulletin. Alaska Department of Fish and Game. Juneau, Alaska, USA.
- CARNES J. C., V. VANBALLENBERGHE, AND J. M. PEEK. 1996. Ecology of wolves on the Copper and Bering River Deltas, Alaska. Unpublished Progress Report. University of Idaho. Moscow, Idaho, USA.
- CROWLEY, DAVID W. 2000. Unit 6 brown bear. Survey-inventory management report. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Study 1.0. Grants W-27-1 and W-27-2. Juneau, Alaska, USA.
- GASAWAY W. C., S. D. DUBOIS, D. J. REED, AND S. J. HARBO. 1986. Estimating moose population parameters from aerial surveys. Institute of Arctic Biology. University of Alaska, Fairbanks, Alaska, USA.
- GRIESE, H. J. 1990. Unit 6 moose survey-inventory progress report. Pages 46–63 in S. O. Morgan, editor. Annual report of survey-inventory activities. Part VII. Volume XX. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Project W-23-2, Study 1.0. Juneau, Alaska, USA. 428pp.
- MACCRACKEN J.G. 1992. Ecology of moose on the Copper River Delta, Alaska. Dissertation, University of Idaho, Moscow, Idaho, USA.
- _____, V. VAN BALLEMBERGHE, AND J. M. PEEK. 1997. Habitat relationships of moose on the Copper River Delta in coastal south-central Alaska. Wildlife Monographs. 136.
- NOWLIN, R. A. 1995. Unit 6 moose. Pages 45–65 in M. V Hicks, editor. Survey-inventory management report. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Study 1.0, Grants W-23-5, W-24-1. Juneau, Alaska, USA.
- _____. 1998. Unit 6 moose. Survey-inventory management report. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Study 1.0, Grants W-24-4 and W-24-5. Juneau, Alaska, USA.
- RAUSCH R. 1977. Alaska wildlife management plans, Southcentral Alaska. Alaska Department of Fish and Game. Juneau, Alaska, USA.

STEPHENSON, T. R.; HUNDERTMARK, K. J.; SCHWARTZ, C. C., AND VANBALLENBERGHE, V. 1998. Predicting body fat and body mass in moose with ultrasonography. *Canadian Journal of Zoology*. 76:717-722.

VIERECK L. A., C. T. DYRNESS, AND A. R. BATTEN. 1986. The 1986 revision of the Alaska vegetation classification. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Institute of Northern Forestry. Fairbanks, Alaska, USA.

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Table 1 Unit 6 moose estimated population composition and size, 1992–03.

Unit	Regulatory year	Bulls: 100 cows	Calves(%)	Adults	Population size	90% C.I.	Total moose observed
6A (East)	1992–93	-	8	384	416	373–459	378
	1995–96	-	10	253	282	249–316	162
	2000–01 ^a	-	13	136	-	-	189
	2001–02	-	15	265	285	220–360	218
6A (West)	1992–93	23	12	259	295	255–334	273
	1995–96	-	14	271	316	272–361	221
	1999–2000	-	13	348	412	181–643	382
	2001–02	-	13	260	297	236–358	253
6B	1992–93	19	17	271	328	268–387	203
	1994–95	22	10	266	296	244–347	182
	1996–97	-	6	289	308	249–367	167
	1998–99	-	9	266	320	243–396	286
	2000–01 ^a	-	11	159	-	-	178
	2001–02	-	13	144	198	176–219	168
6C	1992–93	26	25	225	299	263–335	204
	1994–95	27	14	242	281	205–358	236
	1996–97	-	17	214	259	232–287	216
	1998–99	-	25	221	334	293–375	293
	2000–01	-	10	278	354	307–402	308
	2001–02	-	20	272	341	318–365	326

^a Composition count

Table 2 Unit 6 moose harvest and accidental death, 1998–2003.

Unit	Regulatory year	Hunter harvest					Estimated			Accidental	
		Reported					Unreported	Illegal	Total	death	Total
		M	(%)	F	(%)	Total ^a					
6A (East)	1998–99	13	(100)	0	(0)	13	1	0	1	0	14
	1999–2000	17	(100)	0	(0)	17	1	0	1	0	18
	2000–01	19	(100)	0	(0)	19	1	0	1	0	20
	2001–02	12	(100)	0	(0)	12	1	0	1	0	13
	2002–03	13	(100)	0	(0)	13	1	0	1	0	14
6A (West)	1998–99	19	(95)	1	(5)	20	0	2	2	0	22
	1999–2000	19	(90)	2	(10)	21	1	1	2	0	23
	2000–01	28	(80)	7	(20)	35	1	1	2	0	37
	2001–02	28	(88)	4	(13)	32	1	1	2	0	34
	2002–03	14	(78)	4	(22)	18	1	1	2	0	20
6A TOTAL	1998–99	32	(97)	1	(3)	33	1	2	3	0	36
	1999–2000	36	(95)	2	(5)	38	2	1	3	0	41
	2000–01	47	(87)	7	(13)	54	2	1	3	0	57
	2001–02	40	(91)	4	(9)	44	2	1	3	0	47
	2002–03	27	(87)	4	(13)	31	2	1	3	0	34
6B	1998–99	23	(100)	0	(0)	23	0	0	0	0	23
	1999–2000	19	(90)	2	(10)	21	1	1	2	0	23
	2000–01	7	(88)	1	(13)	8	1	1	2	0	10
	2001–02	13	(100)	0	(0)	13	0	0	0	0	13
	2002–03	15	(100)	0	(0)	15	0	0	0	0	15

Table 2 Continued

Unit	Regulatory year	Hunter harvest					Estimated			Accidental	
		Reported					Unreported	Illegal	Total	death	Total
		M	(%)	F	(%)	Total ^a					
6C	1998–99	19	(79)	5	(21)	24	0	0	0	0	24
	1999–2000	19	(83)	4	(17)	23	1	1	2	2	27
	2000–01	20	(80)	5	(20)	25	1	1	2	3	30
	2001–02	20	(80)	5	(20)	25	0	0	0	0	25
	2002–03	21	(81)	5	(19)	26	0	0	0	0	26
6D	1998–99	0	(0)	0	(0)	0	0	1	1	0	1
	1999–2000	3	(100)	0	(0)	3	0	0	0	0	3
	2000–01	2	(100)	0	(0)	2	0	1	1	0	3
	2001–02	2	(100)	0	(0)	2	0	1	1	0	3
	2002–03	0	(0)	0	(0)	0	0	1	1	0	0
Unit 6	1998–99	75	(93)	6	(7)	81	1	3	4	0	85
TOTAL	1999–2000	77	(91)	8	(9)	85	4	3	7	2	94
	2000–01	76	(85)	13	(15)	89	4	4	8	3	100
	2001–02	75	(89)	9	(11)	84	2	2	4	0	88
	2002–03	63	(88)	9	(13)	72	2	2	4	0	76

^aTotals may include moose of unknown sex and unit.

Table 3 Unit 6 moose harvest data by permit hunt, 1998–2003.

Unit/hunt no.	Regulatory year	Legal moose	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls	(%)	Cows	(%)	Total reported harvest
6A/RM160 ^a	1998–99	Bull	64	52	39	58	20	(95)	1	(5)	21
	1999–2000	Bull	75	56	45	52	17	(100)	0	(0)	17
	2000–01	Bull	95	46	53	45	23	(100)	0	(0)	23
	2001–02	Bull	84	50	43	57	24	(100)	0	(0)	24
	2002–03	Bull	68	63	48	52	13	(100)	0	(0)	13
6A/DM160 ^b	1998–99	Bull	5	40	33	67	2	(100)	0	(0)	2
	1999–2000	Bull	5	20	50	50	2	(100)	0	(0)	2
	2000–01	Bull	5	0	0	100	5	(100)	0	(0)	5
	2001–02	Bull	5	0	20	80	4	(100)	0	(0)	4
	2002–03	Bull	5	40	67	33	1	(100)	0	(0)	1
6A/DM162	1998–99	No hunt									
	1999–2000	Antlerles	5	40	33	67	0	(0)	2	(100)	2
	2000–01	Antlerles	15	33	30	70	0	(0)	7	(100)	7
	2001–02	Antlerles	15	67	20	80	0	(0)	4	(100)	4
	2002–03	Antlerles	5	20	0	100	0	(0)	4	(100)	4
6B/RM164	1998–99	Bull	201	33	83	17	23	(100)	0	(0)	23
	1999–2000	Bull	206	36	83	14	19	(100)	0	(0)	19
	2000–01	Bull	171	37	89	7	7	(88)	1	(13)	8
	2001–02	Bull	160	34	87	12	13	(100)	0	(0)	13
	2002–03	Bull	138	36	81	18	16	(94)	1	(6)	17

Table 3 Continued

Unit/hunt no.	Regulatory year	Legal moose	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls	(%)	Cows	(%)	Total reported harvest
6B/DM166	1998–99	No hunt									
	1999–2000	Antlerless	5	20	50	50	0	(0)	2	(100)	2
	2000–01	No hunt									
	2001–02	No hunt									
	2002–03	No hunt									
6C/DM167	1998–99	Bull	20	5	0	100	19	(100)	0	(0)	19
	1999–2000	Bull	20	5	0	100	19	(100)	0	(0)	19
	2000–01	Bull	20	5	0	100	19	(100)	0	(0)	19
	2001–02	Bull	20	0	0	100	19	(100)	0	(0)	19
	2002–03	Bull	5	0	0	100	5	(100)	0	(0)	5
6C/DM168	1998–99	Antlerless	5	0	0	100	0	(0)	5	(100)	5
	1999–2000	Antlerless	5	20	0	100	0	(0)	4	(100)	4
Fed. Subsist.	2000–01	Antlerless	6	0	0	100	1 ^b	(17)	5	(83)	6
Fed. Subsist.	2001–02	Antlerless	5	0	0	100	1 ^b	(17)	5	(83)	6
Fed. Subsist.	2002–03	Both sexes	20	0	0	100	16	(100)	4	(0)	20

^a RM prefix was a registration hunt, DM prefix a drawing hunt.

^bPotlatch moose

Table 4 Unit 6 moose hunter residency and success, 1998–2003.

Unit	Regulator year	Successful					Unsuccessful					Total hunter
		Local ^a resident	Nonlocal resident	Nonresident	Total	(%)	^b Local resident	Nonlocal resident	Nonresident	Total	(%)	
6A (East)	1998–99	2	0	11	13	(62)	5	0	3	8	(38)	21
	1999–00	2	3	12	17	(44)	3	2	17	22	(56)	39
	2000–01	2	5	12	19	(43)	6	4	15	25	(57)	44
	2001–02	3	0	8	11	(28)	5	2	11	29	(73)	40
	2002–03	0	0	13	13	(27)	9	3	22	35	(73)	48
6A (West)	1998–99	13	5	2	20	(61)	11	1	1	13	(39)	33
	1999–00	14	5	2	21	(57)	11	5	0	16	(43)	37
	2000–01	25	5	5	35	(51)	24	9	0	33	(49)	68
	2001–02	22	6	4	32	(62)	14	5	1	20	(38)	52
	2002–03	15	2	1	18	(58)	11	0	2	13	(42)	31
6A TOTAL	1998–99	15	5	13	33	(61)	16	1	4	21	(39)	54
	1999–00	16	8	14	38	(50)	14	7	17	38	(50)	76
	2000–01	27	10	17	54	(48)	30	13	15	58	(52)	112
	2001–02	25	6	12	43	(47)	19	7	12	49	(53)	92
	2002–03	0	0	0	0	()	20	3	24	48	(100)	48
6B	1998–99	20	3	- ^c	23	(17)	106	5	- ^c	111	(83)	134
	1999–00	20	1	- ^c	21	(16)	98	13	- ^c	111	(84)	132
	2000–01	7	1	- ^c	8	(8)	92	4	- ^c	96	(92)	104
	2001–02	13	0	0	13	(12)	85	7	0	92	(88)	105
	2002–03	13	2	0	15	(17)	67	5	0	72	(83)	87

Table 4 continued

Unit	Regulatory year	Successful					Unsuccessful					Total hunter
		Local ^a resident	Nonlocal resident	Nonresident	Total	(%)	^b Local resident	Nonlocal resident	Nonresident	Total	(%) ^c	
6C	1998–99	20	4	- ^c	24	(96)	1	0	- ^c	1	(4)	25
	1999–00	19	4	- ^c	23	(85)	2	2	- ^c	4	(15)	27
	2000–01	22	3	- ^c	25	(100)	0	0	- ^c	0	(0)	25
	2001–02	18	7	0	25	(96)	0	1	0	1	(4)	26
	2002–03	25	0	0	25	(100)	0	0	0	0	(0)	25
6D	1998–99	0	0	0	0	(0)	3	5	0	8	(100)	8
	1999–00	2	0	1	3	(20)	10	2	0	12	(80)	15
	2000–01	0	2	0	2	(12)	10	5	0	15	(88)	17
	2001–02	2	0	0	2	(11)	13	3	0	16	(89)	18
	2002–03	1	0	0	1	(4)	21	1	1	23	(96)	24
Unit 6	1998–99	55	12	13	80	(36)	126	11	4	141	(64)	221
TOTAL	1999–00	57	13	15	85	(34)	124	25	17	166	(66)	251
	2000–01	56	16	17	89	(34)	133	23	15	171	(66)	260
	2001–02	58	13	12	83	(34)	118	18	12	159	(66)	242
	2002–03	39	2	0	41	(22)	108	9	25	143	(78)	184

^a Resident of Unit 6.

^b Totals may include harvest by hunters of unknown residency and may include harvest from unknown units.

^c Nonresidents ineligible to receive permits.

Table 5 Unit 6 moose harvest percent by time period, 1998–2003.

Unit	Regulatory year	Harvest periods							n
		8/20-8/31	9/1-9/15	9/16-9/30	10/1-10/15	10/16-10/31	11/1-11/30	12/1-12/31	
6A (East)	1998–99	0	38	38	15	8	0	0	13
	1999–2000	0	18	18	53	12	0	0	17
	2000–01	0	32	26	21	21	0	0	19
	2001–02	0	25	17	17	33	8	0	12
	2002–03	0	31	8	31	31	0	0	13
6A (West)	1998–99	0	100	0	0	0	0	0	20
	1999–2000	0	81	5	10	5	0	0	21
	2000–01	0	31	57	11	0	0	0	35
	2001–02	0	53	44	3	0	0	0	32
	2002–03	0	44	50	0	6	0	0	18
6A TOTAL	1998–99	0	76	15	6	3	0	0	33
	1999–2000	0	53	11	29	8	0	0	38
	2000–01	0	31	46	15	7	0	0	54
	2001–02	0	45	36	7	9	2	0	44
	2002–03	0	39	32	13	16	0	0	31

Table 5 Continued

Unit	Regulatory year	Harvest periods							n
		8/20-8/31	9/1-9/15	9/16-9/30	10/1-10/15	10/16-10/31	11/1-11/30	12/1-12/31	
6B	1998–99	13	87	0	0	0	0	0	23
	1999–2000	11	68	21	0	0	0	0	19
	2000–01	25	75	0	0	0	0	0	8
	2001–02	14	79	0	0	0	7	0	14
	2002–03	0	100	0	0	0	0	0	15
6C	1998–99	0	58	4	29	8	0	0	24
	1999–2000	0	57	35	4	4	0	0	23
	2000–01	0	44	28	12	12	4	0	25
	2001–02	0	52	17	22	9	0	0	23
	2002–03	0	50	25	25	0	0	0	20
6D	1998–99	0	0	0	0	0	0	0	0
	1999–2000	0	67	33	0	0	0	0	3
	2000–01	0	50	50	0	0	0	0	2
	2001–02	0	100	0	0	0	0	0	2
	2002–03	0	0	0	0	0	0	0	0
Unit 6 TOTAL	1998–99	4	74	8	11	4	0	0	80
	1999–2000	2	58	20	14	5	0	0	83
	2000–01	2	39	37	12	8	1	0	89
	2001–02	2	54	24	10	7	2	0	83
	2002–03	0	56	23	14	8	0	0	66

Table 6 Unit 6 moose harvest percent by transport method, 1998–2003.

Unit	Regulatory year	Airplane	Boat	3- or 4- wheeler	ORV	Highway Vehicle	n
6A (East)	1998–99	77	8	15	0	0	13
	1999–2000	76	6	12	0	6	17
	2000–01	53	11	21	0	16	19
	2001–02	67	0	25	0	8	12
	2002–03	100	0	0	0	0	13
6A (West)	1998–99	25	75	0	0	0	20
	1999–2000	29	71	0	0	0	21
	2000–01	34	63	0	0	3	35
	2001–02	27	73	0	0	0	30
	2002–03	28	72	0	0	0	18
6A TOTAL	1998–99	45	48	6	0	0	33
	1999–2000	50	42	5	0	3	38
	2000–01	41	44	7	0	7	54
	2001–02	38	52	7	0	2	42
	2002–03	58	42	0	0	0	31

Table 6 Continued

Unit	Regulatory year	Airplane	Boat	3- or 4- wheeler	ORV	Highway Vehicle	n
6B	1998–99	22	56	0	0	13	23
	1999–2000	18	53	0	0	41	19
	2000–01	0	70	0	0	30	10
	2001–02	17	58	0	8	25	13
	2002–03	20	73	0	0	7	15
6C	1998–99	0	37	4	4	54	24
	1999–2000	0	65	9	0	26	23
	2000–01	4	39	0	0	57	23
	2001–02	9	27	5	5	55	25
	2002–03	0	40	5	5	50	24
6D	1998–99	0	0	0	0	0	0
	1999–2000	0	33	0	0	67	3
	2000–01	50	0	0	0	50	2
	2001–02	0	50	0	0	50	2
	2002–03	0	0	0	0	0	0
Unit 6 TOTAL	1998–99	25	38	4	1	20	80
	1999–2000	27	49	5	0	19	85
	2000–01	27	45	4	0	24	89
	2001–02	25	46	5	3	22	83
	2002–03	32	48	2	2	17	70

MOOSE MANAGEMENT REPORT

From: 1 July 2001

To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 7 (3520 mi²)

GEOGRAPHIC DESCRIPTION: Eastern Kenai Peninsula

BACKGROUND

The moose population in Unit 7 is at low density relative to other units on the Kenai Peninsula. The population is expected to remain at low density unless significant habitat alteration occurs. Widespread spruce bark beetle (*Dendroctonus rufipennis*) infestations that began in the 1990s have impacted more than 500,000 hectares of spruce forests on the Kenai Peninsula (www.borough.kenai.ak.us/sprucebeetle). Since 2001 infestation rates are decreasing as the number of unaffected trees becomes scarce (U.S.D.A. et al. 2003). Much of the affected forest has been or is scheduled for salvage logging. The impact of spruce mortality and salvage logging efforts will affect the quality of moose habitat over a large scale, but the nature of the effect remains uncertain. About 10% of the Kenai Peninsula's moose harvest over the past 20 years has come from Unit 7. Available moose habitat can be limiting in winter during heavy snow accumulations.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVE

To maintain a healthy population of moose with a minimum bull-to-cow ratio of 15:100.

METHODS

Composition surveys are flown in traditional count areas as funding allows. Harvest data come from hunter information taken from harvest tickets. All of the harvest data is now kept at ADF&G's Web-based database called WinfoNet. This report reflects updated data in all tables using data from WinfoNet, so data may differ slightly from past reports.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

A unitwide survey has never been conducted in Unit 7. Composition surveys, combined with harvest reports, suggest the moose population has remained relatively stable during the past decade. The actual number of moose counted during composition counts is not comparable between years because survey intensity and conditions are inconsistent. Composition counts are

performed in order to get an adequate sample of moose to calculate ratios of bulls to cows and calves to cows. Composition counts conducted in 3 count areas during the winter of 2001–02 showed 30 bulls:100 cows and 13 calves:100 cows (Table 1). No surveys were conducted in 2002–03.

MORTALITY

Harvest

Season and Bag Limit. The general season in Unit 7 has been 20 Aug–20 Sep since 1993. Since 1987 the bag limit has been 1 bull with a spike or fork on at least 1 antler, or 50-inch antlers, or antlers with 3 or more brow tines on at least 1 side (SF/50).

The 5-year average reported harvest for Unit 7 was 49 moose (Table 2).

Board of Game Action and Emergency Orders. There were no board actions for Unit 7 during the reporting period.

Permit Hunts. Information for permit hunts DM210 and DM211, which encompass both Unit 7 and Unit 14C, are provided in the Unit 14C management report. Permit hunt DM522, which encompasses area within both Units 7 and 15A, took 2 bulls in 2001 and no bulls in 2002 (Table 3).

Hunter Residency and Success. About half of the hunters were residents of Unit 7 (Table 4). Success rate averaged 14% over the past 5 seasons (Table 4).

Harvest Chronology. Moose were harvested throughout the season, but in somewhat larger proportions at the start and end of the season (Table 5). The chronology of the harvest is dependent on weather conditions and other factors unrelated to moose abundance.

Transport Methods. Highway vehicles and horses encompass the majority of transportation methods used by successful hunters in Unit 7 (Table 6).

Other Mortality

Motor vehicles killed an average of 24 moose per year during the past 5 years (Table 2) in Unit 7. The impact of predation on moose by wolves and bears is unknown. The level of mortality for moose during severe winters is probably high.

HABITAT

Assessment

Reduction of beetle-killed forest stands through salvage logging has been underway for more than a decade. Postlogging site preparation that encourages hardwood regeneration beneficial for moose habitat has been recommended to local foresters. If site preparation is done properly, resulting in a healthy regeneration of hardwoods, habitat quality for moose will probably increase greatly. However, if site preparation is not conducted or done inadequately, blue-joint grass (*Calamagrostis canadensis*) will initially crowd out hardwood and spruce seedlings, creating less desirable moose habitat and slowing forest succession.

CONCLUSIONS AND RECOMMENDATIONS

Recent bull:cow ratios have been higher than the recommended minimum objective of 15 bulls:100 cows. However, the limited count areas surveyed may not accurately reflect the ratio across the unit. Adequate bull-to-cow ratios are desired to minimize the length of the rut and ensure most cows conceive during their first estrous cycle (Schwartz et al. 1994). Given the low moose density in Unit 7, a higher ratio than 15 bulls:100 cows ratio may be desirable.

LITERATURE CITED

SCHWARTZ, C. C., K. J. HUNDERTMARK AND E. F. BECKER. 1994. Growth of moose calves conceived during the first versus second estrus. *Alces* 30:91–100.

U.S. DEPARTMENT OF AGRICULTURE, U.S. FOREST SERVICE, AND ALASKA DEPARTMENT OF NATURAL RESOURCES-DIVISION OF FORESTRY. February 2002. Forest Insect and Disease Conditions in Alaska-2002, General Technical Report R10-TP-113.

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Table 1 Unit 7 fall aerial moose composition counts and estimated population size, 1998–2003

Regulatory year	Bulls: 100 Cows	Yearling bulls: 100 Cows	Calves: 100 Cows	Calves (%)	Adults	moose observed	population size
1998–99	42	8	12	8	226	245	~900
1999–2000	45	8	29	16	126	151	~900
2000–01	52	8	12	7	99	107	~900
2001–02	30	4	13	9	184	203	~900
2002–03	no surveys conducted						~900

Table 2 Unit 7 general season moose harvest and accidental death, 1998–2003

Regulatory year	Reported				Estimated			Accidental death			Grand Total
	M	F	Unk	Total	Unreported	Illegal	Total	Road	Train	Total	
1998–99	46	0	1	47			20	46	7	53	119
1999–2000	39	0	1	40			20	24	3	27	87
2000–01	51	0	0	51			20	24	0	24	95
2001–02	55	0	0	55			20	12	9	21	96
2002–03	50	0	1	51			20	16	0	16	87

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 3 Units 7 moose harvest for drawing permit hunts, 1998–1003

Hunt Area	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Males	Females	Unk.	Illegal	Total harvest
DM522 ^a	1998–99	--	--	--	--	--	--	--	--	0
	1999–2000	25	16	90	10	2	0	--	--	2
	2000–01	25	32	76	24	4	0	--	--	4
	2001–02	25	16	90	10	2	0	--	--	2
	2002–03	25	28	100	0	0	0	--	--	0

^a New hunt in 1999 which includes areas within Units 15A and 7

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 4 Unit 7 moose hunter residency and success for the general season, 1998–2003

Regulatory year	Successful				Unsuccessful				Total Hunters
	Local ^a resident	Nonlocal resident	Nonresident	Total ^b (%)	Local ^a resident	Nonlocal resident	Nonresident	Total ^b (%)	
1998–99	23	21	3	47 (12)	147	182	14	345 (88)	392
1999–2000	12	16	8	40 (13)	119	120	7	261 (87)	301
2000–01	16	29	5	51 (15)	126	156	11	294 (85)	345
2001–02	23	26	5	55 (17)	111	146	16	273 (83)	328
2002–03	23	22	6	51 (15)	132	136	12	280 (85)	331

^a Local = residents of Unit 7

^b Includes unspecified residency

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 5 Unit 7 harvest chronology % for general season moose harvest, 1998–2003

Regulatory year	Harvest periods						Unknown	<i>n</i>
	8/20–25	8/26–8/31	9/1–9/5	9/6–9/10	9/11–9/15	9/16–9/20		
1998–99	28	2	11	13	28	13	4	47
1999–2000	10	10	13	23	20	20	5	40
2000–01	22	4	24	2	27	16	6	51
2001–02	22	2	7	16	25	27	2	55
2002–03	20	6	12	10	14	33	6	51

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 6 Unit 7 % harvest by transport method for general season moose harvest, 1998–2003

Regulatory year	Percent of harvest						Highway vehicle	Unknown	<i>n</i>
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV			
1998–99	7	20	11	4	0	4	50	4	47
1999–2000	25	13	2	0	0	2	48	10	40
2000–01	12	29	8	2	0	2	41	6	51
2001–02	16	14	14	7	0	4	42	4	55
2002–03	6	24	10	2	0	0	53	6	51

All data has been updated from the ADF&G online database: WildlifeInfoNet

MOOSE MANAGEMENT REPORT

From: 1 July 2001

To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 9 (33,600 mi²)

GEOGRAPHIC DESCRIPTION: Alaska Peninsula

BACKGROUND

Moose were scarce on the Alaska Peninsula before the mid 1900s, but they increased dramatically and spread southwest during the 1950s and 1960s. The scarcity of suitable habitat south of Port Moller limited expansion into Subunit 9D. Even during the 1960s when the population was growing, calf:cow ratios were relatively low, and the ratio declined as the population reached its peak. Evidence of range damage from overbrowsing was evident, and nutritional stress probably caused poor calf survival. Liberal hunting regulations were in effect from 1964 to 1973, first to slow population growth and subsequently (during the early 1970s) to reduce the population so that willow stands could recover from heavy browsing. Even though a series of hunting restrictions began after 1973, the population continued to decline, especially in Subunit 9E. By the early 1980s moose densities in Unit 9E were 60% below peak levels and calf:cow ratios were extremely low, despite evidence that range conditions had improved (ADF&G files). Brown bear predation on neonatal moose was the primary limiting factor of moose in Unit 9.

MANAGEMENT DIRECTION

POPULATION OBJECTIVES

Population objectives for moose in Unit 9 are to: 1) maintain existing densities in areas with moderate (0.5–1.5 moose/mi²) or high (1.5–2.5 moose/mi²) densities; 2) increase low-density populations (where habitat conditions are not limiting) to 0.5 moose/mi²; 3) maintain sex ratios of at least 25 bulls:100 cows in medium-to-high density populations and at least 40 bulls:100 cows in low-density areas.

METHODS

We scheduled fall sex and age composition aerial surveys throughout Subunits 9B, 9C, and 9E during November through early December when adequate snow cover was available. We collected harvest data from harvest tickets, monitored harvests, and checked hunters primarily within the Naknek River drainage.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Results of fall sex and age composition surveys in Subunits 9B, 9C, and the central portion of 9E indicated that populations in most of Unit 9 have stabilized over the past 17 years. Very low

moose densities and unreliable snow conditions in Subunit 9A, 9D, and the southern portion of 9E hindered surveys for monitoring trends in population size or composition.

In March 1999 the Board of Game found that moose in Subunits 9B, 9C, and 9E met the criteria to be considered “important for providing high levels of human consumptive use” under the intensive management legislation.

Population Size

A 1983 census in the central portion of Subunit 9E resulted in an estimate of 1148 moose (90% CI = $\pm 16\%$) in the 1314-mi² study area. Extrapolation of this census to the remainder of 9E provided a rough estimate of approximately 2500 moose. The area of Subunit 9C outside of Katmai National Park had approximately 500–600 moose. There were approximately 2000 moose in Subunit 9B. Subunits 9A and 9D probably contained about 300 and 200 moose, respectively.

Population Composition

Poor snow cover and weather conditions precluded surveys in 9B during this reporting period (Table 1) and prevented surveys in the majority of Unit 9 in 2002. Because weather conditions are a chronic problem, the Alaska Department of Fish and Game will continue seeking new moose survey techniques for Unit 9.

Two trend areas in 9C were surveyed in 2001, but weather precluded surveys in 2002. Bull:cow ratios were relatively stable in 2001 compared to prior ratios (Table 2). Moose populations in the trend areas surveyed are considered moderate densities (Branch River Trend Area mean density = 0.9 moose/mi² and Park Border Trend Area mean density = 0.8 moose/mi²); therefore, the overall ratio of 30 bulls:100 cows was within management objectives (i.e. ratio > 25 bulls:100 cows). The calf:cow ratios in 9C were extremely low in 2001.

Surveys in 9E were conducted in cooperation with the U.S. Fish and Wildlife Service in 2001. Extremely poor snow cover prevented surveys in most trend areas in 2002. The overall bull:cow ratios in the areas surveyed exceeded the management objective of at least 25:100 with an overall ratio of 48 bulls:100 cows in 2001 (Table 3). The only trend area with less than 40 bulls:100 cows was the Blue Mountain Trend Area, which had 25 bulls:100 cows in 2001. The lower bull:cow ratio in this trend area is consistent with the most prior composition survey, which estimated 27 bulls:100 cows in 1999. The ratio of 20 calves:100 cows observed in 2002 is among the highest observed in 9E in the past 25 years, but the ratio only includes the Anchor-Ivan Trend Area, which historically has had a higher calf:cow ratio when compared with other trend areas in 9E. The estimated calf:cow ratio in 9E was 11 calves:100 cows in 2001, when more trend areas were included in the survey ($n = 4$). In 2001, 48% of all bulls seen ($n = 99$) had antlers with ≥ 50 ” spread. Total sample sizes and ratios from these areas indicate the population in 9E is relatively stable and harvests are not reducing bull:cow ratios.

While conducting line transect surveys for bears in May and June of 2002, 86 moose were observed in Unit 9D, of which 17 were calves. Because the data was collected during the moose calving season and the survey was not designed to assess moose populations, no useful

comparisons can be derived from the number of calves observed. The observed sex composition was 87 bulls: 100 cows, indicating a population that is not heavily hunted.

MORTALITY

Harvest

Seasons and Bag Limit. As federal subsistence management becomes more entrenched, the number of regulation changes and divergence of state and federal regulations is increasing. In Subunit 9A, resident and nonresident hunters could hunt 1–15 Sep with a bag limit of 1 bull.

In Subunit 9B, nonresidents could hunt 5–15 Sep with a bag limit of 1 bull with ≥ 50 -inch antlers or ≥ 4 brow tines; and resident hunters could hunt 1–15 Sep and 15 Dec–15 Jan, with a bag limit of 1 bull. Effective in 1997, meat of moose taken in Subunit 9B was required to remain on the bone until processed for human consumption. The federal subsistence season in 9B is 20 Aug–15 Sep and 1 Dec–15 Jan.

The nonresident season dates in Subunit 9C were the same as 9B; however, the nonresident bag limit was 1 bull with ≥ 50 -inch antlers or ≥ 3 brow tines. The resident fall season has remained the same as 9B, but the resident winter season dates in 9C were different in the Naknek River drainage and the remainder of 9C. Within the Naknek drainage only bulls could be taken during the state hunting season 1–31 Dec. In the remainder of 9C, any moose was legal 15 Dec–15 Jan during the 2001–02 hunting season. In 2002 the legal animal for the winter season in the remainder of 9C was changed to 1 bull. Within the southern portion of the Naknek drainage, the federal subsistence season was open 20 Aug–15 Sep under a registration permit (RM233). In December federal lands were only open to local rural residents, and a subsistence registration permit (RM232) was required to take antlerless moose. In the remainder of 9C, the federal winter subsistence winter season was 1–31 Dec, and any moose was legal outside the Naknek drainage during the 2001–02 regulatory year. In 2002 the legal animal for the federal winter season outside of the Naknek Drainage was changed to 1 bull.

The nonresident season in Subunit 9E was 10–20 Sep, and the bag limit was 1 bull with an antler spread of ≥ 50 inches or at ≥ 3 brow tines. The state season for resident hunters in 9E was 10–20 Sep and 1 Dec–20 Jan. The bag limit was 1 bull; however, moose taken in September must have a spike or fork or have an antler spread of ≥ 50 inches or have ≥ 3 brow tines. In 2001 the federal subsistence seasons in 9E were changed to 20 Aug–20 Sep and 1 Dec–20 Jan with a bag limit of 1 bull.

Unit 9D was open only to residents with a state drawing permit (hunt DM312) 15 Dec–20 Jan with a bag limit of any bull in 2001. The number of permits issued annually by the state was increased from 10 to 20 in 2001. Starting in 2002 federal subsistence permits were issued to local residents for any bull with a quota of 10 bulls from both the state and federal hunts. The season dates for the federal hunt were 15 Dec–20 Jan.

The Unit 9 harvests during this reporting period were less than the average harvest over the past 20 years (mean = 217, SD = 33, range 170–300). During the 2001–02 regulatory year, hunters

reported killing 175 moose, including 167 bulls and 8 cows (Table 4). In the 2002–03 regulatory year, 175 moose were harvested, including 170 bulls, 3 cows and 2 unknown.

Board of Game Actions and Emergency Orders. In 2001 the fall portion of the federal hunt in Subunit 9E was extended to 20 Aug–20 Sep. During the 2002 regulatory year, changes were enacted for both state and federal moose regulations. The legal animal for the state and federal winter hunts in the remainder of Subunit 9C was changed to allow only the harvest of bulls. The number of permits issued for moose in 9D was increased to 20, and a federal season for subsistence users was initiated in 9D from 15 Dec to 20 Jan.

Permit Hunts. Federal subsistence registration permits are required for the early fall season (RM233) and the December antlerless moose hunt (RM232) within the Becharof National Wildlife Refuge in Subunit 9C. A quota of 5 antlerless moose was set for RM232. Since 1996, a total of 25 permits have been issued for RM233, and 1 bull has been harvested. From 1996–2003 a total of 54 permits were issued for RM232, and 3 cows have been harvested.

Eighteen people applied for the 20 registration permits (DM312) available for Subunit 9D in 2001, and 23 people applied for 20 available permits in 2002. Of the people who received permits in 2001, three reported hunting, but were unsuccessful at harvesting a moose. Five people reported hunting in 2002, and a harvest of 2 bulls was reported. In 2002 federal subsistence registration permits (RM009) were also available to residents of 9D. One permit was issued, but poor weather prevented this individual from hunting.

Hunter Residency and Success. The number of moose hunters using Unit 9 increased during 1981–87 and peaked at 645. Since then the number leveled off at a mean of 531 for the period 1990–99. In 2000, 2001, and 2002, 468, 435, and 443 moose hunters reported using Unit 9, respectively (Table 5), indicating a decrease in the number of hunters using Unit 9 in recent years. While there have been fluctuations in the proportion of hunters in the 3 residency categories (local resident, nonlocal resident, and nonresident), the decline in the number of hunters was not attributed to any one group. Most subsistence hunters did not get moose harvest tickets and consequently were not represented in the local resident category. Since 1988 the success rates have been relatively stable for all 3 residency groups. Nonresidents typically had a higher success rate (mean = 52% from 1990 to 2002, range = 43–59%) than either residents of Unit 9 (mean = 35% from 1990 to 2002, range = 26–79%) or other Alaska residents (mean = 31% from 1990 to 2002, range = 19–38%) because virtually all of them flew out to hunt, and many employed guides.

Harvest Chronology. Since 1988, approximately 87% of the total moose harvest occurs in September (Table 6). Harvest levels during the winter season have remained low and ranged from 3 to 14% of the total harvest from 1998 to 2002, depending on weather and travel conditions.

Transportation Methods. No major change in transportation type has occurred during the past 5 years. Aircraft continued as the most common method of transportation in Unit 9. Boats were the second most common transport mode (Table 7).

Other Mortality

Given the continued low calf production, bear predation of neonatal moose appears to remain the primary cause of natural mortality. Bear:moose ratios in Unit 9 ranged from >1:1 to 1:10, and they were much higher than anywhere else within the indigenous range of moose.

CONCLUSIONS AND RECOMMENDATIONS

Hunting regulations have been restricted in all units to eliminate antlerless moose hunting due to low calf:cow ratios. Additionally, fall seasons have recently been shortened and moved to the first half of September in the northern 3 subunits to maintain bull:cow ratios at prescribed levels. The average harvest of 197 moose per year since 1998 appears to be within sustainable levels. Harvests have remained relatively stable for 17 years, despite major changes to moose regulations (i.e., the spike/fork-50" regulation) in other parts of Alaska. The reduced annual harvests since 2000 are not thought to reflect changes in the moose population, because fewer hunters have reported hunting in Unit 9 in recent years and hunter success rates have not decreased.

Brown bear predation on neonatal moose was the major limiting factor preventing an increase in moose densities in Unit 9. However, very high bear:moose ratios would require substantial reduction in bear densities to achieve a measurable improvement in moose calf survival. ADF&G has placed a priority on managing bears in Unit 9, and any drastic reduction in bear numbers would probably be opposed by a large segment of the public.

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Table 1 Moose composition counts in Unit 9B, 1998–2002

Year	Males: 100 females	Yearling males: 100 females	Calves: 100 females	Calf %	Adults	Total moose	Moose/hour
1998	48	7	19	11	189	213	19
1999	57	10	4	2	132	135	26
2000	-	-	-	-	-	-	-
2001	-	-	-	-	-	-	-
2002	-	-	-	-	-	-	-

Table 2 Moose composition counts in Unit 9C, 1998–2002

Year	Males: 100 females	Yearling males: 100 females	Calves: 100 females	Calf %	Adults	Total moose	Moose/hour
1998	-	-	-	-	-	-	-
1999	37	3	9	6	516	550	38
2000	33	2	7	5	290	306	52
2001	30	3	9	7	271	290	42
2002	-	-	-	-	-	-	-

Table 3 Moose composition counts in Unit 9E, 1998–2002

Year	Males: 100 females	Yearling males: 100 females	Calves: 100 females	Calf %	Adults	Total moose	Moose/hour
1998 ^a	65	13	20	11	817	913	45
1999	48	6	10	6	154	164	43
2000	-	-	-	-	-	-	-
2001	48	12	11	7	305	328	34
2002 ^a	74	27	20	11	87	97	47

^a Includes some surveys by U.S. Fish and Wildlife Service.

Table 4 Annual moose harvest in Unit 9, 1998–2002

Year	Reported			Estimated			Total
	Male	Female	Total ^a	Unreported	Illegal	Total	
1998	198	2	200	100		100	300
1999	238	8	253	100		100	353
2000	176	2	180	100		100	278
2001	167	8	175	100		100	275
2002	170	3	175	100		100	275

^a Includes unknown sex.

Table 5 Moose hunter residency and success in Unit 9, 1998–2002

Year	Successful				Unsuccessful			
	Local resident	Nonlocal resident	Nonresident	Total ^a	Local resident	Nonlocal resident	Nonresident	Total ^a
1998	33	48	115	200	95	114	118	329
1999	53	61	131	253	107	98	124	336
2000	37	29	113	180	112	70	105	288
2001	33	51	89	175	100	92	67	260
2002	35	39	100	175	73	107	84	268

^a Includes unknown residency.

Table 6 Moose harvest chronology (%) in Unit 9, 1998–2002

Year	August 20–31	September 1–4	September 5–9	September 10–15	September 16–20	December 1–15	December 16–31	January 1–20
1998	<1	6	17	47	21	6	3	-
1999	<1	3	21	45	17	5	5	4
2000	<1	6	18	51	22	0	3	0
2001	<1	5	18	51	14	3	7	1
2002	<1	5	15	50	15	11	3	0

Table 7 Successful moose hunter transport methods (%) in Unit 9, 1998–2002

Year	Airplane	Horse	Boat	3- or 4- wheeler	Snowmachine	ORV	Highway vehicle	Unspecified
1998	66	0	24	2	5	0	1	2
1999	64	0	18	4	10	0	2	2
2000	63	0	24	6	2	1	1	3
2001	60	0	25	5	7	0	2	1
2002	68	0	25	3	0	1	2	1

MOOSE MANAGEMENT REPORT

From: 1 July 2001

To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 11 (12,784 mi²)

GEOGRAPHIC DESCRIPTION: Chitina Valley and the eastern half of the Copper River Basin

BACKGROUND

Moose abundance in Unit 11 was generally considered low from the early 1900s until the 1940s, increased during the 1950s, and reached a peak population in the early 1960s. When moose were most abundant, between 85 and 120 moose per hour were observed during fall composition counts. The moose population declined from the late 1960s until 1979, when the population was considered to have reached its lowest level. In 1979 only 12 moose per hour were observed during fall counts. Moose numbers stabilized, then started increasing during the early to mid 1980s and probably peaked in 1987 when 55 moose per hour were observed. Moose numbers declined between 1990 and 1991 following severe winters, then increased slightly during the mid 1990s.

Moose harvests in Unit 11 averaged 164 (123–242) per year from 1963 until 1974. Either-sex bag limits were in effect until 1974, and cows made up as much as 50% of the harvest. During this period, hunting seasons were long and split between a fall and winter season. The moose harvest and the total number of hunters peaked in the early 1970s. In response to declining moose numbers, the 1974 fall moose season was shortened, the winter season was closed, and the harvesting of cows was prohibited. Between 1975 and 1989, fall seasons remained 1–20 September. In 1990 the moose season was shortened in response to deep snow conditions and to align it with the Unit 13 season. The current state season and bag limit, which was established in 1993, is slightly more liberal.

Most of Unit 11 was included in Wrangell–Saint Elias National Monument in December 1978. In 1980 monument status was changed to park/preserve with passage of the Alaska National Interest Lands Conservation Act.

MANAGEMENT DIRECTION

POPULATION OBJECTIVE

- Allow the population to fluctuate as dictated by available habitat and predation rates.
- Maintain a population with a posthunt minimum of 30 bulls:100 cows with 10–15 adult bulls:100 cows.

HUMAN USE OBJECTIVE

- Allow human harvest of bulls when it does not conflict with management goals for the unit or population objectives for the herd.

METHODS

An aerial survey was conducted every year during the late fall to determine sex and age composition and population trends on a count area along the western slopes of Mount Drum. Harvests and hunting pressure were monitored through a harvest ticket reporting system. Predation and overwinter mortalities were monitored in the field whenever possible and by reports from hunters and trappers.

Large portions of Unit 11 are classified as limited fire suppression zones, where wildfire is allowed to burn. Unfavorable weather conditions for burning have occurred in recent years, and wildfires impacted little or no habitat this reporting period.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

The number of moose observed during fall sex and age composition surveys in Count Area (CA) 11 (the western slopes of Mount Drum) increased during this reporting period (Table 1). Historically, the number of moose counted has fluctuated between years in this count area. Moose movements and survey conditions probably account for some of the yearly variation. The average number of moose observed and moose per hour counted over three-year periods were compared to smooth annual variation in survey results due to snow condition and sightability. From 1994 to 1996, an average of 132 moose (.46 moose/mi²) at a rate of 29 per hour were observed. The three-year average between 1999 and 2001 was 106 moose (.37 moose/mi²) at 24 per hour, down 20% from 1994–96. Because of an absence of snow in 2002, a count was not completed. The 2003 count of 138 moose, at a rate of 30 moose per hour, suggests moose numbers may have increased slightly during the past 2 years.

Population Size

An accurate population estimate is not available for all of Unit 11 because a complete census has never been conducted. Moose numbers observed during the 2003 fall composition counts in CA-11 (212 mi²) resulted in a density estimate of 0.5 moose per mi². Density estimates from 0.1 to 0.4 moose/mi² were calculated in 1986 during late winter stratification surveys when 20% of the estimated 5200 mi² of moose habitat in the unit was surveyed. Based on these density estimates, an extrapolated population estimate of approximately 2500 moose was obtained. During the fall of 1993 National Park Service (NPS) biologists conducted a Gasaway census in portions of Unit 11. The density estimate was 0.58 moose/mi² and the extrapolated population estimate from this survey was 3000 moose (Bill Route, NPS, personal communication). During the late 1990s, declines in the number of moose counted in CA-11 suggest moose abundance may have fallen below the 1993 NPS estimate.

Population Composition

The bull:cow ratio in CA-11 in 2003 was 115:100 (Table 1). The bull:cow ratio has averaged 120:100 for the 5 years between 1997 and 2001. These bull:cow ratios have been among the highest ever observed in CA-11. This adult bull:cow ratio greatly exceeds the current management goal of maintaining no less than 30 total and 15 adult bulls:100 cows.

The calf:cow ratio in CA-11 was 15:100 in 2003, up 67 percent from the 2001 ratio of 9:100 (Table 1). Fall calf:cow ratios in CA-11 fluctuate considerably annually, with a 3-year average of 18 calves:100 cows. Unfortunately counts were not completed in 2002, though count data from adjacent GMU 13 indicated increased calf:cow ratios in the fall of 2002. An increase in yearling bulls in CA-11 during 2003 suggests there may have been an increase in calves during 2002. Calf:cow ratios below 20:100 in the fall suggest a low level of recruitment and an inability for the population to increase.

Distribution and Movement

Data from past fall composition and winter stratification surveys, field observations, and reports from the public indicate the highest moose numbers in the unit are along the slopes of Mt. Sanford, Mt. Drum, and Mt. Wrangell. Portions of Unit 11 south of the Chitina River have the lowest density of moose in the unit.

Fall rutting and postrutting concentrations normally occur in upland habitats to elevations as high as 4000 feet. Migrations to lower elevations are initiated by snowfall, but usually do not occur until late November–early December. By late winter moose numbers in riparian habitats along the Copper and Chitina Rivers are at their highest levels for the year. Some moose from the western slopes of Unit 11 move to lower elevations in a westerly direction across the Copper River to winter in eastern Unit 13.

MORTALITY

Harvest

Seasons and Bag Limit. The state season is 20 August–20 September with a bag limit of 1 bull with spike-fork antlers or 50-inch antlers or antlers with 3 or more brow tines on at least 1 side. The federal subsistence season has the same dates with a bag limit of 1 bull.

The combined state and federal harvest for moose in Unit 11 during 2001 was 42 moose (Table 2). Many hunters receive both state moose harvest tickets and federal subsistence moose permits and hunt in GMU 11. Unfortunately, there is some double reporting in which a hunter fills in both the harvest ticket and federal permit with identical data, and harvests and effort data are inflated. Known cases of double reporting are subtracted from the estimated total harvest data; however, harvest ticket and permit data do not have double reports subtracted and reflect slightly higher values than actually occur. Thirty-one moose were reported taken in 2001 under state regulations (Table 3) and 15 reported under federal regulations (Table 4). In 2002 the state harvest was 33, but harvest data were not available for the federal hunt. Moose harvests increased during this reporting period after reaching a low of 27 bulls taken in 1998. Hunting pressure increased in 2001 with 119 individuals reported hunting under the state harvest ticket (Table 3) and 124 rural residents obtaining federal subsistence moose permits (Table 4). During

the late 1980s hunting effort was high with an average of 187 individuals reported hunting moose in Unit 11 compared to an average of 118 during the mid 1990s. Hunting effort is up since 2000 because of federal subsistence permits being available for any bull and because of displacement of hunters from Unit 13, where moose hunting opportunities have declined substantially.

Illegal and unreported harvests of both bulls and cows have been documented in Unit 11 and, in some years, may be as much as 20% of the reported harvest. Poaching activity is assumed to be greatest along the Nabesna and McCarthy Roads, where vehicle access allows for hunting and transporting illegally taken moose without being observed. It is also unknown how many small bull moose are taken off state land yet reported as legal under the federal registration permit. With 2 different bag limits for the same area, it is difficult to limit the harvest of small bulls because they are legal under the federal subsistence regulations on federal land.

Board of Game Actions and Emergency Orders. During the spring 1993 board meeting the Unit 11 season was changed to 20 August–20 September, and the bag limit was changed to 1 bull with spike-fork antlers or antlers with a minimum 50-inch width or 3 brow tines. This action aligned the state moose season and bag limit in most game management units on the road system in Southcentral Alaska. In 2000 the NPS initiated a registration permit hunt for federal subsistence hunting in Unit 11 by residents of designated communities in the resident zones of Units 11 and 13.

Hunter Residency and Success. Table 3 gives residency breakdowns for successful and unsuccessful moose hunters in the state hunt. Local rural residents accounted for 30% (n=10) of the total moose taken in Unit 11 during 2002 while nonresidents only took 24% (n=8). The remainder (n=13) went to non-local Alaska residents. Harvest rates by locals in the state hunt declined starting in 2000 because the federal subsistence permit hunt was established. Also, NPS regulations allow local rural residents to hunt in those portions of the unit designated as park. Because nonlocal residents and nonresidents can hunt only on preserve lands, they are excluded from much of the unit. Also, local residents can take any size bull under current subsistence regulations on federal lands, while nonlocals and nonresidents must take a spike-fork or 50-inch bull under state regulations.

The hunter success rate in 2002 was 27% for the state hunt, similar to the prior 2 years but down slightly from the 5-year average of 31%. The decline in 2000 success rate for the state hunt could be attributed to some hunters reporting under the federal permit. Success rates for federal hunters were lower at 19% and 12% in 2000 and 2001. Successful hunters spent an average of 6.1 days to kill a moose in 2002, while unsuccessful hunters averaged 7.7 days in the field. The time needed to take a moose increased slightly during this reporting period.

Harvest Chronology. Chronology data indicate more moose are taken during the later portion of the season in Unit 11 (Table 5). Bull moose are more vulnerable then because their movements increase at the onset of rut in mid September, which is also during leaf fall.

Transportation Methods. Unit 11 moose hunters use aircraft, 3-or 4-wheelers and highway vehicles for access to hunting areas (Table 6). NPS regulations limit transportation methods in Unit 11. Aircraft cannot be used in portions of the unit designated as park, and all vehicle use for

sport hunting is restricted to existing trails by permit only. Subsistence hunters do not need a permit and are not limited to existing trails. These rules limit hunting opportunity in the more remote portions of the unit.

Natural Mortality

Predator-prey studies have not been conducted in Unit 11. Wolves and brown bears are abundant, but predation rates are unknown. Field observations of wolf kills during winter, coupled with reports by hunters and trappers of suspected wolf predation, indicate that wolves are important predators of moose in the unit. Brown bear predation is less apparent because it occurs during early summer, and detection is difficult. The low calf:cow ratios observed during fall counts indicate early calf mortality similar to that observed in areas with high brown bear predation on neonatal moose calves. The Unit 11 moose population will probably remain at low densities as long as predation limits recruitment. This suppression can occur over long periods when alternative prey such as sheep and caribou are available (Gasaway et al. 1983) as they are in Unit 11.

HABITAT

Assessment

Fires occurred throughout much of Unit 11 prior to the mid 1940s when the Bureau of Land Management (BLM) instituted fire suppression activities. The beneficial effects of those fires were reached in the 1960s, and moose numbers were high over much of the unit. Only one fire, the Wilson Camp Fire, has burned enough acreage in the past 30 years to produce a substantial amount of moose browse. That fire occurred in 1981 and covered 13,000 acres. Recent fires have either received initial fire suppression activities, or if not put out, have not had favorable burning conditions or fuel supplies. Currently vast areas within the unit support stands of mature spruce, many of which have been killed by spruce bark beetles and have limited value as moose habitat. Habitat types that moose currently use are climax upland and riparian willow communities.

Enhancement

Habitat manipulation to benefit moose is not currently an option because most of the unit is included in Wrangell–Saint Elias National Park and Preserve. Although NPS regulations prohibit habitat manipulation, Unit 11 is included in the Copper River Fire Management Plan with most remote areas under the limited suppression category.

CONCLUSIONS AND RECOMMENDATIONS

An increase in the number of moose counted and the moose per hour figures in CA-11 leads to the conclusion that moose numbers in the western portion of Unit 11 may have increased slightly over the past 2 years. A slight increase was observed in moose numbers during fall counts in Unit 13 as well, and this was attributed to the mild winters in 2001 and 2002, as well as a slight reduction in wolf numbers.

Unit 11 has relatively high numbers of brown bears and wolves. In areas with low calf:cow ratios and abundant bears and wolves, predation on calves has been shown to be an important limiting factor. Fall surveys have shown chronically low calf:cow ratios in Unit 11. Because of this, the moose population may remain relatively stable at the current low density for a long period.

Yearly fluctuations may occur when predation rates change because of snow conditions and winter severity.

Moose hunting patterns changed considerably in Unit 11 during this reporting period. Prior to this reporting period, hunting pressure and harvest were declining. This trend reversed in 1999, with both hunting pressure and the harvest increasing. The reasons for this change include the assumption that more hunters were displaced from Unit 13 because of the dramatic decline in both moose numbers and the change in season length and definition of a legal bull. Also, prior to 2000 all moose hunting in Unit 11 was monitored under the state harvest ticket system, including the federal subsistence harvest. In 2000, the NPS initiated a registration permit hunt for the federal subsistence hunt, and hunting pressure and harvests reached levels not seen in more than 10 years. Whether this effort will continue is unknown because moose numbers are low and access extremely limited. Much of the moose harvest comes from the same area each year, where there is reasonable access. An increased harvest in heavily hunted federal areas undoubtedly includes smaller bulls protected under the state SF/50 regulation. Once these available bulls are harvested, the overall take may decline because calf production/survival is low and bull recruitment is insufficient to support high harvests for very long. Also, hunters will not be able to move to new areas because of NPS access regulations.

I recommend a research program be established to investigate factors limiting growth of the moose population. Unit 11 has the potential to support more moose. The population objective of maintaining moose at existing densities (i.e., 0.3 and 0.5 moose/mi²) needs to be reconsidered and perhaps increased. We also need to explore options available to managers to enhance the moose population consistent with NPS regulations. I also recommend reviewing the control and enforcement of the moose harvest in Unit 11. Dual management creates numerous enforcement and reporting problems, such as taking illegal moose on state or private land and reporting it as a federal subsistence moose.

LITERATURE CITED

GASAWAY, W. C., R. O. STEPHENSON, J. L. DAVIS, P. E. K. SHEPERD, AND O. E. BURRIS. 1983. Interrelationships of wolves, prey and man in interior Alaska. Wildlife monograph 84.

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Table 1 Unit 11 Moose composition counts in Count Area 11, 1998–2003.

Year	Males: 100 females	Yearling males: 100 females	Calves: 100 females	Calf %	Adults	Total moose	Moose /hour	Density ² moose/mi ²
1998–99	111	9	15	7	97	104	24	0.4
1999–00	109	11	21	9	111	122	28	0.4
2000–01	157	3	24	9	95	104	23	0.4
2001–02	94	4	9	4	89	93	19	0.3
2002–03	N/A	--	--	--	--	--	--	--
2003–04	115	7	15	7	129	138	30	0.5

Table 2 Unit 11 Moose harvest^a and accidental death, 1998–2003.

Regulatory year	M	Reported F	Total ^b	Unreported	Estimated Illegal	Total	Total
1998–99	27	0	28	5	5	10	38
1999–00	38	0	40	5	5	10	50
2000–01	45	0	45	5	5	10	55
2001–02	41	1	42	5	5	10	52
2002–03 ^c	33	0	33	5	5	10	43

^a Includes state harvest tickets and federal registration permit hunts. Double reporting occurred 8 times in 2000 and 4 times in 2001.

^b Includes unknown sex.

^c Federal harvests for 2002 not yet available.

Table 3 Unit 11 Moose hunter residency and success for general state harvest ticket hunt only, 1998–2003.

Regulatory year	Successful				Unsuccessful			
	Local resident	Nonlocal resident	Non Resident	Total ^a	Local resident	Nonlocal resident	Non-resident	Total ^a
1998–99	18	8	2	28	65	13	1	80
1999–00	25	9	6	40	37	41	4	83
2000–01	13	8	4	30	35	40	4	80
2001–02	8	12	8	31	49	34	3	119
2002–03	10	13	8	33	50	30	8	121

^a Includes unspecified residency.

Table 4 Unit 11 Federal subsistence permit hunt, 2000–2003.

Hunt	Regulatory year	Permits issued	Percent Did not Hunt	Number (%)	Number (%)	Bulls	Cows	Unknown	Harvest
				Unsuccessful Hunters	Successful Hunters				
RM 714	2000–01	119	0	96 (81)	23 (19)	23	0	0	23
	2001–02	124	0	109 (88)	15 (12)	14	1	0	15
	2002–03	N/A							

Table 5 Unit 11 Moose harvest (%) chronology by seasonal weeks for general state harvest ticket hunt only, 1998–2003.

Regulatory Year	Season Dates	Week of Season				
		1st	2nd	3rd	4th	5th
1998–99	20 Aug–20 Sep	0	4	22	41	33
1999–00	20 Aug–20 Sep	14	11	8	30	38
2000–01	20 Aug–20 Sep	7	3	10	27	53
2001–02	20 Aug–20 Sep	7	7	7	30	50
2002–03	20 Aug–20 Sep	13	0	23	29	35

Table 6 Unit 11 Successful moose hunter transport methods (%) for general state harvest ticket hunt only, 1998–2003.

Regulatory Year	Airplane	Horse	Boat	3- or 4- Wheeler	Snowmachine	ORV	Highway vehicle	Unknown
1998–99	29	0	0	32	0	7	25	7
1999–00	33	0	3	33	0	8	23	3
2000–01	47	0	0	27	0	7	17	3
2001–02	55	0	3	26	0	6	10	0
2002–03	36	3	15	24	0	6	12	3

MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003^a

LOCATION

GAME MANAGEMENT UNIT: 12 (10,000 mi²)

GEOGRAPHIC DESCRIPTION: Upper Tanana and White River drainages

BACKGROUND

Following federal wolf control, the Unit 12 moose population irrupted during the 1950s through the mid 1960s. Moose numbers declined rapidly during the early 1970s, similar to populations in adjacent road accessible areas. Several severe winters, high wolf and grizzly bear predation, and high localized cow moose harvests all contributed to the population decline. Cow moose hunts were stopped after 1974, and the Nabesna Road moose season was closed entirely from 1974 through 1981. Between 1986 and 1991, the Little Tok River drainage was closed to moose hunting because of low yearling recruitment and a declining bull:cow ratio. Between the mid 1970s and early 1980s, the Unit 12 moose density was estimated between 0.2 and 0.4 moose/mi² (ADF&G, unpublished data).

In response to the declining moose populations, wolf control programs were conducted in adjacent Units 20D (1980), 20E (1981–1983), and in northern Unit 12 (1981–1983). Beginning in regulatory year (RY) 1982, which begins 1 July and ends 30 June (e.g., RY82 = 1 Jul 1982–30 Jun 1983), attempts were made to reduce the grizzly bear population by liberalizing grizzly bear hunting regulations. Moose habitat enhancement programs were conducted during the late 1980s and again in 1997. Between 1982 and 1989 the moose population in Unit 12 increased, probably due to a combination of these management programs and favorable climatic conditions that prevailed during this period. However, the population remained at low density (0.4–0.6 moose/mi²).

Unit 12 has been an important moose hunting area for local residents, hunters from Southcentral Alaska, and guided nonresidents. It is also an important wildlife viewing area for tourists driving the Alaska Highway. The Upper Tanana Valley is the first area in Alaska visited by thousands of highway travelers who come to view Alaska's wildlife. During the 1960s when the Unit 12 moose population was high, hunting seasons and bag limits were liberal and hunter participation and success were high. Moose were commonly viewed while

^a This unit report also includes data collected outside the reporting period at the discretion of the reporting biologist.

traveling the area's highways. During that period, needs of consumptive and nonconsumptive users were met. Since the unit's moose population declined to a low level, the hunting season and bag limit have become restrictive and harvest has declined by over 40%.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Protect, maintain, and enhance the moose population in concert with other components of the ecosystem.
- Continue sustained opportunities for subsistence use of moose.
- Maximize sustained opportunities to participate in hunting moose.
- Maximize opportunities for the nonconsumptive use of moose.

MANAGEMENT OBJECTIVE

- Maintain a minimum posthunting sex ratio of 40 bulls:100 cows east of the Nabesna River and a minimum ratio of 20 bulls:100 cows in the remainder of the unit.

INTENSIVE MANAGEMENT OBJECTIVES

- Population: 4000–6000 moose.
- Harvest: 250–450 moose annually.

METHODS

POPULATION ESTIMATION AND COMPOSITION SURVEYS

We estimated the moose population size in an 1120-mi² portion of northwestern Unit 12 during November 1994 and October 1997. Methods followed standard Gasaway survey techniques (Gasaway et al. 1986), except the areas were stratified using historic count data collected during aerial contour counts or population estimation surveys. The area in northwestern Unit 12 was divided into 34 high density and 42 low–medium moose density strata sample units in 1994. Based on 1994 and 1996 survey results, we restratified the area into 37 high and 39 low–medium strata sample units in 1997. We flew 24 random sample units (16 high, 8 low–medium) covering approximately 32% of the study area during 1994 and 27 random units (19 high, 9 low–medium) covering 37% of the area during 1997. Standard search intensity was about 4.25 min/mi² in 1994 and 3.45 min/mi² in 1997. Portions of 12 sample units (1994; 8 highs, 4 lows) and 14 units (1997; 9 highs, 5 lows) were resampled at a search intensity of 12 min/mi² to determine a sightability correction factor.

During 2000–2003, in cooperation with Tetlin National Wildlife Refuge staff, we estimated moose population size and composition using the Geostatistical Population Estimator method (GSPE; Ver Hoef 2001), a modification of the standard Gasaway et al. (1986) technique, in all of Unit 12 excluding those portions of the Nabesna, Chisana, and White River drainages

within Wrangell–St. Elias National Park and Preserve. All moose habitat in this area was divided into high (≥ 2 moose/sample unit) or low (< 2 moose/sample unit) strata. During each year, between 60–65% of the sampled areas were high strata. A simple random sample of sample units was selected from each stratum using Microsoft® Excel for Windows® 2000 software. Previous analyses suggest survey effort and the precision of population estimates are optimized when the survey effort includes approximately 40% low density and 60% high-density sample units. The GSPE method does not yet employ a sightability correction factor, so does not correct for moose not seen during the survey. Rather, the GSPE method employs greater search intensity of 8–10 min/mi² vs. 4–6 min/mi² (Gasaway et al. 1986), resulting in a higher level of sightability. All moose observed were classified as either large bulls (antlers > 50 inches), medium bulls (antlers larger than yearlings but < 50 inches), small bulls (spike, cerviform, or palmate-antlered [no brow separation] yearling bulls), cows, calves, or unidentified moose.

The National Park Service (NPS) conducted a “no-stratification” population estimation survey (Dale et al. 1994) in a 352-mi² area in the vicinity of Chisana in southeast Unit 12 during October 1998 (NPS, Wrangell–St Elias National Park and Preserve, unpublished data).

We conducted aerial composition surveys in October and November 1993–1999 in 4–9 traditional trend count areas. All moose observed were classified as either large bulls (antlers > 50 inches), medium bulls (antlers larger than yearlings but < 50 inches), small bulls (spike, cerviform, or palmate-antlered [no brow separation] yearling bulls), cows without calves, cows with 1 calf, cows with 2 calves, lone calves, or unidentified moose. These data were used to estimate population and composition trends by comparing moose observed per hour and composition ratios between years.

HARVEST

Harvest was estimated using harvest reports. To increase the reporting rate, reminder letters were sent to hunters who did not initially report. Information obtained from the reports was used to determine total harvest, hunter residency and success rates, harvest chronology, and transportation used. Harvest data were summarized by regulatory year. Estimates of moose legally harvested outside the hunting season for ceremonial potlatches were obtained by interviewing residents and public safety officers of villages where potlatches took place.

HABITAT

Enhancement

We made significant progress in developing a cooperative wildlife habitat logging plan with the Department of Natural Resources/Division of Forestry to increase deciduous browse and cover for wildlife and to provide nursery structure for planted spruce seedlings. The Robertson River Prescribed Burn Plan was completed in 2001 and may be implemented in summer 2005.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Based on data collected during annual October–November aerial composition surveys and area-specific population estimation surveys during 1989, 1990, 1994, 1997, 1998, 2000, and 2001, the moose population in Unit 12 increased slowly from 1982 to 1989 and remained relatively stable from 1989 to 1993. The Unit 12 moose population grew slightly during 1994–1997, possibly due to increased calf survival. The population remained stable during 1998–2003. During the growth phase in 1994–1997, the most apparent increase occurred in the northwest portion of the unit within the area affected by the 1990 Tok wildfire (155 mi²). Population estimates indicate this area supported 0.19 moose/mi² in 1989, 0.6 moose/mi² by 1994, and about 1.0 moose/mi² in 1997.

The 1999 estimated population range was 3500–4000 moose using results from past year's population estimates and composition surveys conducted in 1999. The 2001 Unit 12 population estimate was 3450–4300 moose ($\pm 16\%$, 90% CI), with an estimated density of 0.6–0.7 moose/mi² of suitable moose habitat (6000 mi²). The 2003 Unit 12 population estimate was 2900–5100 moose ($\pm 22\%$, 90% CI), with an estimated density of 0.6–0.7 moose/mi² of suitable moose habitat (6000 mi²).

Localized moose harvest caused declines in moose numbers near villages and communities in Unit 12. Poaching and legal harvest for funeral and ceremonial potlatches had the greatest effect, because cow moose were often harvested. Since the 1990s, the Fish and Wildlife Protection officer in Tok has conducted intensive public awareness campaigns explaining the limiting effects of poaching on local moose numbers. In addition, we have worked with the local villages to improve potlatch moose harvest reporting and to develop a strategy to meet cultural needs but limit the harvest to more sustainable levels. These efforts have been largely unsuccessful; however, a recent effort by village councils and local community leaders to heighten awareness appears to be creating a positive change.

The Alaska Board of Game identified the moose population in Unit 12 as important for high levels of human consumptive use under the Intensive Management Law (AS 16.05.255[e]–[g]). This designation means the board must consider intensive management if regulatory action to significantly reduce harvest becomes necessary because the population is depleted or has reduced productivity. The board set the Unit 12 intensive management (IM) population objective at 4000–6000 moose and IM harvest objective at 250–350 moose. The Unit 12 moose population is at the lower end of the IM population objective, but calf survival is not high enough to allow the IM harvest objective to be met. Based on modeling of the Unit 12 trends in moose population, and hunter participation and harvest, the moose harvest must be maintained at 130 bulls and distributed throughout the unit to protect the bull segment of the population, especially in the more accessible areas of the unit. Significantly increasing the moose population and the sustainable harvest will require intensive management to reduce the effects of wolf and bear predation on moose survival.

Past research found that predation by both wolves and bears was the primary factor maintaining the area moose populations at low densities (0.2–1.0 moose/mi², Gasaway et al. 1992; U.S. Fish and Wildlife Service, unpublished data). Because the moose population in the northwest portion of the unit increased as a result of the 1990 Tok wildfire and intense public hunting and trapping of predators, other local moose population increases may be attainable in Unit 12 without government wolf control. These moose population increases probably would be moderate and would eventually be limited by predation. However these population increases should be enough to satisfy the minimum intensive management objectives for the next 3 years.

Population Composition

We conducted moose composition surveys in Unit 12 during fall 1988–2003 (Table 1). Composition data since 1994 are not directly comparable with previous years because sampling techniques changed. Prior to 1994, trend count areas within the Tok, Little Tok, Tetlin, Nabesna, and Chisana Rivers were surveyed annually. During 1994, 1997, and 2000–2003 we conducted population estimation surveys over a much larger area, which included the traditional count areas. During 1995, 1996, 1998, and 1999 a portion of the trend count areas were surveyed to protect against missing a catastrophic decline in the area's moose population during years population estimation surveys were not conducted. Benefits of conducting population estimation surveys included confidence limits around composition estimates and, because more area and habitats were sampled, it was less likely that weather or moose distribution anomalies would affect the count. We found calf:cow ratios were lower within the high strata compared to low strata, indicating that most calf:cow pairs select for habitats not normally surveyed during trend counts. Most trend count areas were located within high-density areas to optimize the number of moose surveyed.

During 2000, 2001 and 2003, Tetlin National Wildlife Refuge staff cooperated with us to design moose surveying areas to obtain population and composition estimates for most of Unit 12. We expect this cooperation to continue.

During 2001 and 2003, bull:cow ratios ranged from 25–42:100 in western and northern portions of Unit 12 and 64–89:100 in the eastern and southern portions. Most harvest occurred in the western and northern portions of the unit and in some areas caused the bull:cow ratio to decline. Within the Tok River drainages and along the north side of the Alaska Range the bull:cow ratio declined to the low 20s:100 from the low 30s:100 during the mid to late 1990s but has remained relatively stable since 1999. The Unit 12 bull:cow ratio remained above the population objective.

Annually approximately 50% of the total Unit 12 moose harvest occurred in the Tok River drainage and along the north side of the Alaska Range. Yearling bull recruitment ranged from 7–12:100 and was not adequate to compensate for harvest. The bull:cow ratio stabilized during RY99–RY03 because hunting success rate declined, probably because bull density became so low.

Calf survival to 5 months varied during the report period (Table 1; 15–33:100 cows). The number of calves that survived to 5 months during RY01–RY02 compared to the number of yearling bulls (7–12:100) suggests that wolves were probably the primary predator in Unit 12.

Distribution and Movements

Moose live throughout Unit 12 below an elevation of about 4500 feet. There are about 6000 mi² (15,540 km²) of suitable habitat. There are both migratory and nonmigratory segments of the population. Moose that rut in the Tok River area appear to move the greatest distances. Many cows migrate as far south as the Gakona River for calving, return to the Tok River for the rut, and then move north to the area burned by the 1990 Tok wildfire or to the Tanana River to winter, a straight-line distance of 90–100 miles (144–160 km). While en route to the Tok wildfire area during winters 1999–2000 through 2002–2003, 10–30 moose were consistently observed using an area along the Tok River that was mechanically crushed in 1998.

Moose distribution in Unit 12 changed over the past 10 years. During RY99–RY03, very few resident moose existed on the Northway Flats, in the vicinity of Tanacross, or north of Tok along the Tanana River. Year-round poaching and harvest for funeral or ceremonial potlatches contributed to the decline of resident moose in these lowland areas near human settlements. Also, some of these moose may now be spending more time in the 1990 Tok River burned area. Use of the Tok River valley and Tetlin Hills by moose increased substantially since 1989. Densities increased from 0.19 moose/mi² (fall 1989) to about 1 moose/mi² (fall 1997–fall 2003). Increased use of this area occurred throughout the year and was a result of improved habitat from the 1990 Tok River fire and moderate harvests of predators.

MORTALITY

Harvest

Season and Bag Limit. Seasons and bag limits in Unit 12 are summarized in Table 2.

Alaska Board of Game Actions and Emergency Orders. The Alaska Board of Game split the moose season into 2 periods: 24–28 August and 8–17 September in most of the unit for RY01. This created a 5-day August season for any bull and eliminated the 14-day spike/fork-only August season. In the remainder, that portion east of the Nabesna River and south of the winter trail running southeast from Pickerel Lake to the Canadian border, the season remained 1–30 September. Also in spring 2000, the board established the population objective for Unit 12 at 4000–6000 moose and harvest objective at 250–450 moose.

Hunter Harvest. Reported harvest in Unit 12 was 99 bulls and 2 unknown sex in RY01, 124 bulls in RY02, and 132 bulls, 1 cow and 1 unknown sex in RY03 (Table 3). The 5-year average reported moose harvest was 122. The number of hunters and harvest increased in RY95. Average annual harvest during RY90–RY94 was 92 compared to 123 (34% increase) during RY95–RY03.

Reported harvest represented about 2.5–3.5% of the prehunt Unit 12 population and had little impact on population dynamics. During RY01–RY03 the annual out-of-season take was

estimated at between 25–50 moose. Most of this harvest comprised cow moose. During the early 1990s this harvest was probably as high as 60 moose annually because poaching was more of a problem and was additive to the potlatch take. Most out-of-season harvest occurred near communities and along the road system. Thus, the annual Unit 12 harvest was probably closer to 4–5.5% of the population. Under this harvest rate and these harvest distribution patterns, the moose population near Unit 12 communities continued at low levels.

Hunter Residency and Success. During RY01–RY03, local residents accounted for an average of 52% of moose hunters in Unit 12, nonlocal residents averaged 37% and nonresidents 10%. The number of local and nonresident hunters has remained relatively constant since RY94, but the number of nonlocal hunters has increased. Local hunters took 40–44% of the reported harvested bulls during RY01–RY03, nonlocals took 27–35%, and nonresidents 22–27% (Table 4). The harvest of moose by nonlocal Alaska residents increased during RY99–RY03 compared to RY93–RY98 due to a 33% increase in the number of nonlocal Alaska residents who hunted in Unit 12.

During RY01–RY03, 520–567 hunters reported hunting moose in Unit 12 (Table 4). The 5-year average was 540 compared to the average of 494 between RY94 and RY98, a 9% increase. Increased participation by nonlocal Alaska residents, mostly from Southcentral Alaska, accounts for a majority of the increase in hunters. This trend also occurred in adjacent Unit 20E. During RY01–RY03 the average success rate in Unit 12 was 22% compared to 25% during RY98–RY00.

Harvest Chronology. During RY91–RY00, an average of 33 bulls were harvested during 1–6 September (Table 5) representing 30% of the fall harvest (range = 27–35%). In an attempt to maintain or reduce the fall harvest in Unit 12, during RY01 the hunting season in most of the subunit was split into 2 periods: 24–28 August and 8–17 September. During RY93–RY00 an average of 27 bulls were harvested during 1–5 September. In RY01–RY03 an average of 11 bulls were harvested during 24–28 August. This represents a reduction of 41% during the first 5 days of the season. This reduction in harvest was not regained during the 10-day September season. The average harvest during RY01–RY03 was 10% lower than the RY98–RY00 average.

The number of hunters who used the 1–30 September season in southern Unit 12 and the total harvest for this season remained similar to past years. Most of these hunters were guided nonresidents or Chisana residents.

Transport Methods. During RY01–RY03, the transportation type used most by successful hunters, on average, was 4-wheelers (37%), followed by boats (20%), highway vehicles (19%), airplanes (18%), horses (13%), and other ORVs (11%) (Table 6). Compared to RY98–RY00, the percentage of harvest by hunters who used 4-wheelers increased from an average of 22% to an average of 37%, while the percentage of the harvest by hunters who used highway vehicles decreased from 23% to 19%. Use of all other transportation types by successful hunters remained relatively constant.

Other Mortality

Predation by wolves and grizzly bears has been the greatest source of mortality for moose in Unit 12 and has maintained the population at a low density (0.4–0.7 moose/mi²) since the mid 1970s. In contrast with most other areas that contain sympatric moose, wolf, and grizzly bear populations, wolves, rather than bears, were the primary predator on moose calves on the Northway–Tetlin Flats, based on research conducted during the late 1980s (ADF&G unpublished data; U.S. Fish and Wildlife Service, unpublished data). Wolf predation also appeared to be the greatest source of adult mortality. However, in some mountainous areas of Unit 12, fall composition data indicate that predation on moose neonates was high, suggesting grizzly bear predation.

Considering the population status and trends of wolves and grizzly bears in Unit 12, I expect the moose population to remain at low density (0.2–1.0 moose/mi²) for an extended period. However, it appears that concentrated public wolf trapping and bear harvest can cause local populations of moose to increase, especially in areas that received habitat enhancement. The likely mechanism is improved calf and yearling survival. Adult mortality probably changes little. Modeling data and survey data support this hypothesis.

HABITAT

Assessment

Only about 6000 mi² in Unit 12 are moose habitat. Excessive wildfire suppression for nearly 30 years allowed vast areas of potentially good moose habitat to become choked with spruce forests that lack high-quality deciduous moose browse. We have conducted browse surveys periodically since the 1970s and found that in most years use of preferred browse species is low in relation to availability. During deep snow winters, moose concentrated in areas along the Tok and Tanana Rivers and the browsing rate was much higher. In all years, disturbed sites with early successional species were used far more heavily than adjacent undisturbed areas. During RY01–RY03 habitat was not limiting the moose population in Unit 12, but medium- to large-scale creation of early seral species could cause the moose population to increase, as evidenced by the 1969 Ladue burn in eastern Unit 20E (Gardner 2000), the 1990 Tok burn, and the Teslin burn in the Yukon (Boertje et al. 1995). Boertje et al. (1995) hypothesized that seral stages reduce predation efficiency in a variety of ways.

Enhancement

During the 1980s over 1800 acres of old age, decadent willows were intentionally disturbed to stimulate crown sprouting of new leaders. Using data collected during our browse surveys, we estimated that these habitat enhancement projects produced over 2 million pounds of additional browse each year for wintering moose. In eastern Unit 12 the U.S. Fish and Wildlife Service has completed several prescribed fires to benefit moose on the Tetlin National Wildlife Refuge since the 1980s.

In 1997 we mechanically crushed 275 acres of decadent willow and aspen within the Tok River valley to stimulate crown growth. We conducted informal surveys in this area during summers 1999 and 2001 and found extensive stands of feltleaf willow (*Salix alaxensis*) and red-stem willow (*Salix planifolia*), preferred moose browse species. In summer 2001 most of

the shrubs were 3–10 feet tall; <1% were above 10 feet and unavailable for moose. We documented continual use of this area during the winter by 10–30 moose and observed increased use as calving habitat.

Since 1998 we have been working in cooperation with the Department of Natural Resources/Division of Forestry to determine suitable logging sites within a proposed 1000-acre timber sale area in the Tok River valley. Potential cut areas are selected based on numbers of marketable trees, historic winter moose use, and the potential to regenerate quality moose browse species. In addition, we are assisting in designing and implementing scarification techniques that will promote willow and aspen regeneration following logging on these sites. Cut areas will be 80–200 acres in size. Logging should begin in winter 2004–2005.

From June to September 1990, a wildfire burned approximately 97,000 acres of primarily decadent black spruce muskeg in the Tetlin Hills and adjacent Tok River lowlands. Quality moose browse species recolonized much of this area and, in response, the area's moose population increased rapidly (0.19 moose/mi² in 1989 to 1.0 moose/mi² by 1997). Excellent moose winter browse supplies are expected to exist for the next 15–20 years.

Local residents observed the increase in moose in the area burned by the 1990 Tok wildfire. As a result, local residents are becoming more receptive to using fire or other habitat enhancement techniques to benefit moose, as evidenced by public support of the planned prescribed burns in the Robertson River and near Tanacross village in 2004–2005.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

If moose numbers are to increase along the road system in Unit 12, the number of cow moose taken for ceremonial and funerary potlatches must decline. The department has tried to address this problem with local villages during village council meetings and Traditional Knowledge workshops but limited corrective steps have been taken. Potlatches are culturally important and should be maintained; however, restrictions on harvest, especially in areas like Unit 12 where the moose densities are very low, should be implemented. In summer 2004 we worked with village residents, the Tanana Chiefs Conference, and ADF&G/Subsistence Division staff to design potlatch moose management that better protects the moose population and still meets the villages' needs.

CONCLUSIONS AND RECOMMENDATIONS

During RY01–RY03 moose were far less numerous in Unit 12 than in the 1960s. The population declined rapidly during the 1970s, increased during the late 1980s, stabilized or slightly declined from 1989 to 1993, increased slightly from 1994 to 1996, and remained stable from 1997 through 2003. Moose numbers, especially in the vicinity of the road system, were very low, which primarily affected subsistence hunters and nonconsumptive users. Every year hundreds of travelers on the Alaska Highway commented on the lack of wildlife in the Upper Tanana Valley. Habitat was not limiting, but predation and out-of-season take in certain areas maintained the moose population at low density. Between 1991 and 1997 the moose population increased within the area affected by the Tok wildfire. Residents of Tetlin

and Tok and a growing number of nonlocal residents increased their hunting in the area and consequently legal and out-of-season harvest stabilized moose population growth.

In more accessible areas of Unit 12 the bull:cow ratio declined to 20–25:100 due to moderate harvest rates and low yearling bull recruitment. In the Little Tok River, an antler restriction regulation was adopted in an attempt to protect the bull:cow ratio but still allow maximum hunter opportunity. Harvest may need to be restricted in a similar manner in the Tok River drainage and along the north face of the Alaska Range because of high harvest rates.

During RY96–RY00 the number of hunters increased by 12% and harvest increased by 32% compared to RY91–RY95. However, in RY01–RY03 when the Unit 12 moose season was split into a 5-day August season for any bull and a 10-day mid September season for any bull, harvest declined by 4% compared to the average annual harvest during RY96–RY00. The most significant change in harvest patterns was the significant increase in the portion of the harvest by hunters using 4-wheelers in RY01–RY03 (37%) compared to RY98–RY00 (22%).

The Alaska Board of Game established population objectives for Unit 12 at 4000–6000 moose and harvest objectives at 250–450 moose. The 2003 population was at or just below the population objective, but recruitment of young moose into the population was not high enough in accessible areas to achieve the board's desired harvest objective. To meet harvest objectives, recruitment of young moose in the more accessible areas of Unit 12, along the road and trail systems, must be improved. Modeling data indicate harvest management objectives could be met in these portions of the unit if intensive habitat management is coupled with elevated public wolf and bear harvest.

The Unit 12 moose management objective to maintain a minimum posthunting sex ratio of 40 bulls:100 cows east of the Nabesna River and a minimum ratio of 20 bulls:100 cows in the remainder of the unit was met during RY01–RY03. The Board of Game's intensive management population objective of 4000–6000 moose was met, but the board's intensive management harvest objective of an annual harvest of 250–450 was not met.

Population trends were monitored. Additional habitat enhancement programs were planned and should be implemented during the next 2 years. Hunting seasons and bag limits were established that allowed maximum hunting opportunity and met subsistence needs. We are continuing to work with local villages to manage moose harvest and reduce the numbers of cows harvested for potlatch ceremonies. Moose viewing opportunities were shared with visitors and local residents, and several presentations were given to local schools and tourist groups annually.

LITERATURE CITED

BOERTJE R.D., D.G. KELLEYHOUSE, AND R.D. HAYES. 1995. Methods for reducing natural predation on moose in Alaska and Yukon: an evaluation. Pages 505–541 *in* L.N. Carbyn, S.H. Fritts, and D.R. Seip, editors. Ecology and conservation of wolves in a changing world. Canadian Circumpolar Institute, Edmonton.

DALE B.W., L.G. ADAMS, AND W.T. ROUTE. 1994. A relatively inexpensive aerial moose survey technique designed as a replacement for trend surveys or for use in areas with high sightability. National Park Service, Anchorage. Unpublished Report.

GARDNER C. 2000. Unit 20E moose management report. Pages 373–393 in M.V. Hicks, editor. Moose management report of survey and inventory activities. Alaska Department Fish and Game. Study 1.0. Juneau, Alaska.

GASAWAY W.C., R.D. BOERTJE, D.V. GRANGAARD, D.G. KELLEYHOUSE, R.O. STEPHENSON, AND D.G. LARSEN. 1992. The role of predation in limiting moose at low densities in Alaska and Yukon and implications for conservation. *Wildlife Monographs* 120.

———, S.D. DUBOIS, D.J. REED, AND S.J. HARBO. 1986. Estimating moose population parameters from aerial surveys. Biological Paper 22. University Alaska Fairbanks.

VER HOEF J.M. 2001. Predicting finite populations from spatially correlated data. 2000 Proceedings of the section on statistics and the environment of the American Statistical Association. pp 93–98.

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TABLE 1 Unit 12 aerial moose composition counts, fall 1988–2003

Year	Bulls:100		Yearling		Moose observed	Adults observed	Calves observed	Percent calves	Moose/hr
	Cows	bulls:100 Cows	Calves:100 Cows	bulls:100 Cows					
1988	64	18	33		1133	943	189	17	40
1989 ^a	50	13	30		1317	1094	223	17	44
1990	47	12	25		1256	1071	185	15	40
1991	49	12	24		1472	1264	200	14	44
1992	45	10	26		1071	906	165	15	32
1993 ^b	26	7	36		850	662	187	22	57
1994 ^c	38	16	39		414	327	87	21	
1994 ^d	97	13	25		421	374	47	11	44
1995 ^d	82	12	26		526	461	65	12	51
1996	39	9	32		1258	1022	236	19	57
1997 ^c	36	11	41		596	458	138	23	
1997 ^d	87	22	31		512	439	73	14	39
1998 ^e	65	14	34		277	229	48	17	
1998 ^f	38	7	29		150	124	26	17	54
1999 ^b	22	8	17		823	721	102	12	65
2000 ^{g,h}	40	9	18		630	558	72	11	
2000 ^{h,i}	84	10	34		268	229	39	15	
2001 ^{g,h}	40	11	27		672	566	106	16	
2001 ^{h,i}	64	18	33		466	400	66	14	
2002 ^{g,h}	42	12	15		350	305	45	13	
2003 ^{g,h}	25	7	32		575	464	111	19	
2003 ^{h,i}	89	15	33		564	475	89	15	

^a Tok and Dry Tok were not surveyed. These survey areas normally yield a sample of 400+ moose.

^b Cheslina and the northern face of the Nutzotin Mountains were not surveyed. These survey areas normally have about 100 bulls:100 cows.

^c Based on population estimation results from northwestern Unit 12.

^d Cheslina, Kalukna, Nabesna, and Chisana count areas were sampled using contour survey techniques.

^e Based on population estimation results from the Chisana area, southwest Unit 12 using the “No-stratification” technique.

^f Only the north face of the Alaska Range sampled using the contour survey technique.

^g Survey area includes state and private lands in western and northern Unit 12. Survey conducted by Alaska Department of Fish and Game.

^h Ratios determined using weighted contributions from high and low sample areas. Actual counts of cows, calves and bulls were not used in estimates.

ⁱ Survey area includes federal and private lands in eastern and southern Unit 12. Survey conducted by Fish and Wildlife Service/Tetlin National Wildlife Refuge.

TABLE 2 Unit 12 moose hunting seasons and bag limits, regulatory years 2001–2002 through 2002–2003

Regulatory year	Area		Season	Bag limit ^a
2001–2002	Unit 12, that portion drained by the Little Tok River upstream from and including the first eastern tributary from the headwaters of Tuck Creek.	Resident:	24–28 Aug 8–17 Sep	1 bull with spike fork antlers or 50 inch antlers or antlers with 4 or more brow tines on at least one side.
		Nonresident:	8–17 Sep	1 bull with spike fork antlers 50-inch antlers or antlers with 4 or more brow tines on at least one side.
	Unit 12, east of the Nabesna River and south of the winter trail running southeast from Pickerel Lake to the Canadian Border.	Resident:	1–30 Sep	1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least one side.
		Nonresident:	No open season	
	Remainder of Unit 12.	Resident:	24–28 Aug 8–17 Sep	1 bull. Or 1 bull.
		Nonresident:	8–17 Sep	1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least one side.
2002–2003	Unit 12, that portion drained by the Little Tok River upstream from and including the first eastern tributary from the headwaters of Tuck Creek.	Resident:	24–28 Aug 8–17 Sep	1 bull with spike fork antlers or 50-inch antlers or antlers with 4 or more brow tines on at least one side.
		Nonresident:	8–17 Sep	1 bull with spike fork antlers or 50-inch antlers or antlers with 4 or more brow tines on at least one side.
	Unit 12, east of the Nabesna River and south of the winter trail running southeast from Pickerel Lake to the Canadian Border.	Resident:	1–30 Sep	1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least one side.
		Nonresident:	No open season	

^a 50-inch antlers defined as having a spread of at least 50 inches or at least 4 brow tines on at least 1 side.

TABLE 3 Unit 12 moose harvest and accidental death, regulatory years 1990–1991 through 2003–2004

Regulatory year	Harvest by hunters									Accidental death		
	Reported						Estimated					
	M (%)		F (%)		Unk	Total	Unreported	Illegal	Total	Road	Total	Total
1990–1991	94	(96)	0	(0)	4	98	15–20	30–40	45–60	4–5	4–5	147–163
1991–1992	109	(99)	0	(0)	1	110	15–20	30–40	45–60	4–5	4–5	159–175
1992–1993	71	(100)	0	(0)	0	71	15–20	30–40	45–60	4–5	4–5	120–136
1993–1994	91	(100)	0	(0)	0	91	15–20	30–45	45–65	5–7	5–7	141–163
1994–1995	87	(100)	0	(0)	1	88	15–20	30–45	45–65	7	7	140–160
1995–1996	117	(100)	0	(0)	1	118	20–25	5–10	25–35	3–5	3–5	146–158
1996–1997	124	(100)	0	(0)	0	124	20–25	3–10	23–35	3–5	3–5	150–164
1997–1998	102	(100)	0	(0)	0	102	20–25	3–10	23–35	3–5	3–5	128–142
1998–1999	148	(99)	1	(1)	0	149	20–25	3–10	23–35	3–5	3–5	175–189
1999–2000	137	(99)	0	(0)	2	139	20–50	3–10	23–60	3–5	3–5	165–204
2000–2001	112	(100)	0	(0)	0	112	20–50	3–10	23–60	3–5	3–5	138–177
2001–2002	99	(98)	0	(0)	2	101	20–50	3–10	23–60	3–5	3–5	127–166
2002–2003	124	(100)	0	(0)	0	124	20–50	3–10	23–60	3–5	3–5	150–189
2003–2004	132	(99)	1	(0)	1	134	20–50	3–10	23–60	3–5	3–5	160–199

TABLE 4 Unit 12 moose hunter residency and success, regulatory years 1990–1991 through 2003–2004

Regulatory year	Successful					Unsuccessful					Total hunters
	Local ^a resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local ^a resident	Nonlocal resident	Nonresident	Unk	Total (%)	
1990–1991	45	26	17	10	98 (23)	186	131	15	0	332 (77)	430
1991–1992	48	49	13	0	110 (27)	160	132	9	4	305 (73)	415
1992–1993	23	35	12	1	71 (15)	222	164	13	9	408 (85)	479
1993–1994	38	33	18	2	91 (24)	186	90	12	1	289 (76)	380
1994–1995	43	28	17	0	88 (19)	240	118	15	1	374 (81)	462
1995–1996	55	34	26	3	118 (24)	249	113	16	0	378 (76)	496
1996–1997	62	41	20	1	124 (24)	251	119	14	0	384 (76)	512
1997–1998	43	29	30	0	102 (21)	245	125	14	0	384 (78)	492
1998–1999	68	46	35	0	149 (29)	232	110	19	0	361 (71)	510
1999–2000	69	41	29	0	139 (25)	240	155	23	0	418 (75)	557
2000–2001	49	41	21	1	112 (21)	241	144	23	1	409 (79)	521
2001–2002	49	27	22	3	101 (19)	242	155	20	2	419 (81)	520
2002–2003	53	43	26	2	124 (23)	212	170	25	0	407 (77)	531
2003–2004	54	44	36	0	134 (24)	230	164	35	4	433 (76)	567

^a Residents of Units 12 and Units 20E and eastern 20D are considered local residents. Major population centers are Eagle, Chicken, Boundary, Northway, Tetlin, Tok, Tanacross, Slana, and Dot Lake.

TABLE 5 Unit 12 moose harvest chronology by month/day, regulatory years 1990–1991 through 2003–2004

Regulatory year	Harvest chronology by month/day						Total ^a
	8/15–8/28	9/1–9/6	9/7–9/13	9/14–9/20	9/21–9/27	9/28–10/5	
1990–1991		18	41	28	4	3	98
1991–1992		34	45	22	4	1	110
1992–1993		25	31	6	4	4	71
1993–1994		29	40	16	4	0	91
1994–1995		25	26	25	3	4	88
1995–1996	2	33	52	17	5	6	118 ^b
1996–1997	1	39	44	27	7	1	124 ^b
1997–1998	1	30	38	19	10	1	102
1998–1999	2	41	65	30	5	1	149
1999–2000	11	37	54	23	3	2	139
2000–2001	4	32	48	16	6	2	112
2001–2002	9	0	41	34	6	4	101
2002–2003	13	0	64	45	0	0 (2 unk)	124
2003–2004	12	2	63	40	12	2 (3 unk)	134

^a Difference between total and summation of harvests by week represents moose taken on unknown dates.

^b One moose was taken during a federal hunt in November 1995.

TABLE 6 Unit 12 moose harvest percent by transport method, regulatory years 1990–1991 through 2003–2004

Regulatory year	Harvest percent by transport method								<i>n</i>
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Unknown	
1990–1991	17	15	21	11	0	6	23	5	98
1991–1992	10	14	10	25	0	14	25	2	110
1992–1993	18	23	10	11	0	10	28	0	71
1993–1994	8	19	15	22	0	16	18	2	91
1994–1995	10	20	19	18	0	7	23	2	88
1995–1996	10	13	28	17	0	6	22	4	118
1996–1997	13	9	22	19	0	7	28	2	124
1997–1998	15	21	16	20	0	3	24	1	102
1998–1999	16	12	17	20	0	11	22	1	149
1999–2000	12	9	16	22	0	12	27	2	139
2000–2001	14	10	19	24	0	12	20	2	112
2001–2002	15	10	20	31	0	9	16	0	101
2002–2003	18	9	15	31	0	10	16	2	124
2003–2004	12	13	16	31	0	10	16	1	134

MOOSE MANAGEMENT REPORT

From: 1 July 2001

To: 30 June 2003^a

LOCATION

GAME MANAGEMENT UNIT: 13 (23,368 mi²)

GEOGRAPHIC DESCRIPTION: Nelchina and Upper Susitna River

BACKGROUND

Moose densities in Unit 13 were low during the early 1900s, but started to increase by the 1940s. Moose were abundant throughout the 1950s, and the population peaked in the mid 1960s. For the next 10 years, moose numbers declined and reached a population low by 1975. Factors contributing to the decline were severe winters, increased predation, and large human harvests of both bulls and cows. The number of moose counted during fall surveys started to increase in 1978 and climbed at an average annual rate of 5% until 1987, when the population peaked again. Moose numbers started to decline again during the early 1990s because of a series of severe winters and increased predation.

Historically, Unit 13 has been an important area for moose hunting in Alaska. Annual harvests were large, averaging more than 1200 bulls and 200 cows during the late 1960s and early 1970s. Hunting seasons were long, with both fall and winter hunts. As moose numbers began to decline, harvests were reduced by eliminating both the cow hunt and winter season in 1972 and reducing fall bull seasons to 20 days in 1975. Harvests in the late 1970s averaged 775 bulls per year, but bull:cow ratios in the population were low. In 1980 the bag limit was changed from any bull to bulls with an antler spread of at least 36 inches or 3 brow tines on at least 1 antler. Under this management regime, the 1980 bull harvest dropped to 557, down 34% from the 1979 harvest of 848. From 1981 through 1988 the harvest increased, peaking in 1988 with a harvest of 1259 moose. Between 1990 and 1993 seasons were reduced in length in response to population declines attributed to severe winters. Moose seasons were again liberalized in 1993 with harvests again increasing and remaining high until the late 1990s.

MANAGEMENT DIRECTION

POPULATION OBJECTIVE

Increase the unit moose population to 20,000–25,000 moose with a minimum of 25–30 calves:100 cows and 10 yearling bulls:100 cows in the fall.

^a This unit report also includes data collected after the end of the reporting period at the discretion of the reporting biologist.

HUMAN USE OBJECTIVE

Increase the yearly moose harvest of bulls and cows to a combined total of 1200–2000 animals. Provide for a subsistence harvest of 600 moose per year.

METHODS

Aerial surveys were conducted during fall to learn sex and age composition and population trends in large count areas distributed throughout the unit. Censuses have been conducted periodically in different portions of the unit to obtain population estimates. Surveys were flown during calving season to determine percent twins at birth. Computer modeling of the moose population was completed to predict trends. Harvests were monitored by requiring permit and harvest ticket reports from all hunters and habitat conditions were checked periodically by examining browse utilization transects in different parts of the unit. Attempts at habitat improvement include updating the Copper River Fire Management Plan. In this plan large portions of the unit are included in a limited fire suppression category in which wildfires are allowed to burn. A controlled burn in the Alphabet hills was ignited in 2003 by Alaska Department of Natural Resources (DNR) and federal Bureau of Land Management (BLM) with approximately 5000 acres burned before unfavorable weather extinguished the fire. In addition, staff evaluated and responded to land-use proposals that could affect moose habitat.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Long-term population trends for moose are monitored by observing changes in the number of moose counted per hour of survey time during fall sex and age trend counts in established trend count areas. This population index is thought to be a reliable indicator of long-term trends in moose numbers because it is not influenced as much by moose movements and survey conditions as the total number of moose counted. Moose per hour data for the current reporting period include 33 moose per hour in regulatory year (RY) 2002 and 49 in RY 2003 (Table 1). The regulatory year begins 1 July and ends 30 June (e.g., RY02 = 1 Jul 2002–30 Jun 2003). The rate of moose counted per hour in Unit 13 declined 54% from 1988 to 2002 going from 72 to 33. This decline was attributed to increased overwinter loss during a series of severe winters in the early 1990s and increased wolf predation that occurred from the mid 1990s on. The increase in moose per hour in 2003 was attributed to increased survival during 2 mild winters from 2001 to 2003 and a decline in wolf predation in 2002. One count area, CA-13, exhibited such a large increase that moose movements into the area, and not just increased survival, contributed to the high count. CA-13 has a history of this type of movement.

Moose censuses were conducted in the moose study area in 13A West during 1994 and 1998–2001. Moose density in 1994 was 2.16 moose and 1.5 cows/mi² (Ward Testa, ADF&G, personal communication). The results from 1998 and 1999 showed a decline, with average densities of 1.4 moose and 1.1 cows/mi². These data indicate a 31% decline in total moose and a 27% decline in cows between 1994 and 1999. The population in 13A West continued to decline in 2000 and 2001. There were .89 moose and .70 cows/mi² in the census area in 2001. The cow population has declined by 54% since 1994 in this area. Survey conditions were

good in all years, and the results are thought to represent an actual decline in moose and not census variation.

We used the predator-prey model developed by Mark McNay (ADF&G, PredPrey v. 1.0) to model moose, wolf, and bear populations in the 13A study area west of Lake Louise. Modeling focused on this area because we have the most complete demographic data for moose, wolves, and bears in this study area. We modeled forward from 1994 to the present and 10 years into the future. The model results closely fit observed historic trends for both moose and wolf numbers in 13A. Future trends predicted by the model include a continued decline in the moose population and an eventual decline in wolf densities once moose numbers drop to a very low level.

Population Size

A unitwide population estimate for moose is not available. Density estimates from fall trend count areas range from a low of 0.5 moose/mi² in 13D to a high of 1.7 moose/mi² in 13C (Table 2). An average of 1.3 moose per mi² was observed within the trend count areas during 2003, up 30% from the 1 moose/mi² estimate the last 3 years. Moose densities observed during the last 5 years are down 35–50% unitwide from the 1987 and 1988 highs of 2 moose/mi². The average density found in count areas cannot be extrapolated unitwide to a population estimate because count areas are located in fall concentration areas; thus, densities are not representative of the whole unit.

Population Composition

Population composition data collected during fall sex and age composition counts from 1998 through 2003 are presented in Table 1. The bull:cow ratio in Unit 13 increased from 18 bulls:100 cows between 1996 and 1998 to 24 bulls:100 cows in 2003–04. An analysis of the bull:cow ratio by age class indicates that there was an increase of 5 yearling bulls:100 cows observed from 2001 to 2003 (Table 1). Recruitment of yearling bulls, however, is still down about 33% from the 12 yearling bulls:100 cows observed in 1988. Fall composition data in 2003 indicates that of the Unit 13 posthunt bull population left to breed, only 12% (94 out of 755) were large bulls. This is important because in portions of Unit 13 where bull:cow ratios are the lowest, the few remaining bulls are also the youngest.

Fall calf:cow ratios in 2002 and 2003 were 23 calves:100 cows and 18 calves:100 cows respectively (Table 1). Between 1978 and 1988 calf production and survival were high, varying from 22 to 31 calves:100 cows each fall. The 23 calves:100 cows observed in 2002 was the only time during this reporting period that the calf:cow ratio even approached ratios observed in the mid 1980s, when moose numbers were increasing in Unit 13. Calf ratios between 1998 and 2000 were the lowest ever observed in GMU 13, averaging only 13 calves:100 cows.

The number of cows counted per hour of survey time is also monitored. Trends in adult cow abundance are more sensitive to population changes because cows are not currently hunted and are more resistant to climatic factors. Between 1986 and 1988 the fall sex and age composition data showed an average cow per hour figure of 47. The 1990–97 average estimate of cows per hour was 39, down by 17%. The cow per hour rate continued to decline,

bottoming out in 2002 at 22 cows per hour, about a 53% overall decrease since the population high in 1988. Cows per hour increased in 2003 to 34.

Productivity

In 13A west, radiocollared moose subjected to ultrasound pregnancy exams during November of 1994, 1995, and 1997 exhibited an average pregnancy rate of 88%, which was maintained until spring in all but one year (Testa 1997). These pregnancy rates approach those observed during the 1980s when calf recruitment to fall was higher. Fall in utero twinning rate was 27% for radiocollared cows in 13A tested by ultrasound. Twinning rate at birth for collared cows in 13A, based on calf observations, has averaged 17% (range = 9–27) between 1994 and 2003. Twinning rates are obtained in other subunits by aerial surveys in early June, just past the peak of parturition. Twinning rates show large annual and spatial fluctuations that probably reflect small sample size more than reproductive change. More extensive surveys were flown during spring 2001 and 2002 in 13 B, C and E. The twinning rate was 15% in 2001 and 31% in 2002. For Interior Alaska moose populations, twinning rates of 20% indicate average productivity.

Distribution and Movements

Data from fall composition surveys, censuses, and stratification flights indicate in recent years moose densities were highest in Units 13A, 13B, and 13C (Table 2). Moose were most abundant along the southern slopes of the Alaska Range in 13B and 13C and the eastern Talkeetna Mountains in 13A. Unit 13D and the Lake Louise Flats in 13A have the lowest observed densities. Historically, moose numbers in 13A west, 13B, and 13C have fluctuated more than in 13A (flats) and 13D.

Fall rutting and postrutting concentrations are in subalpine habitats. The distribution of wintering moose depends on snow depth. Moose move down to wintering areas at lower elevations as snow depth increases. Known winter concentration areas include the upper Susitna River, the eastern foothills of the Talkeetna Mountains, the Tolsona Creek burn, and the Copper River floodplain.

Mortality

Harvest

Season and Bag Limit. Season dates were 1–20 September for the general state moose hunt. The bag limit was 1 bull with a spike/fork antler on 1 side, or 4 brow tines on 1 side, or a spread of 50 inches or more. A Tier II subsistence permit hunt was established in 1995 with 150 Tier II permits issued. Permits are limited to one per household. The Tier II hunting season during this report period was 15–31 August. A federal subsistence hunt has been in place since 1990 for residents of Units 13, 12 and 20 with a bag limit of any bull and season dates of 1 August–20 September in federal subsistence areas only.

The 2001 Unit 13 total reported harvest of 468 moose from all hunts is the lowest take in GMU 13 in 40 years (Table 3). The GMU 13 moose harvest declined 63% between 1993, when 1278 moose were taken, and 2001. Total harvest figures for 2002 are not available, but the projected harvest estimate is 562, a 20% increase from 2001. Total hunting pressure in GMU 13 declined by 43% going from 6110 hunters in 1996 to 3472 in 2002.

Board of Game Actions and Emergency Orders. In 1993 the Board of Game standardized moose seasons and bag limits along the road system in Southcentral Alaska with a bag limit of a spike/fork on 1 side or 50-inch minimum, or 3 brow tines on 1 side, and a 30-day season 20 August–20 September. In 1999 the board reduced the general moose season in GMU 13 by 10 days (1–20 September) and changed the Tier II season dates from 1–19 August to 15–31 August. The 2000–01 moose season was reduced by emergency order in May 2000 for units 13A, B, and E, with season dates of 1–15 September, while 13C and D remained unchanged. During the spring 2001 meeting, the board changed the bag limit from a minimum of 3 brow tines to 4 for the 2001 season and eliminated nonresident moose hunting starting in 2002. During the fall 2003 meeting, the board passed a wolf control program for portions of subunits 13A, B and E.

General Hunt. Harvest ticket returns from 2002 showed 463 bulls and 3 moose of unidentified sex taken by 2705 hunters during the general state hunt (Table 4). Harvests in all units except 13D and 13E increased in 2002.

Permit Hunts. The current federal subsistence hunt replaced a previous state registration subsistence hunt in 1990. The BLM assumed management of subsistence moose hunting on federal land in 1990. Registration permits are issued to residents of Unit 13 (RM 313), as well as residents of those communities in adjacent units (RM 314) that have customary and traditional use determinations in Unit 13. Only small tracts of federal land in 13B and 13D are open to this hunt. Harvests under this permit hunt are presented in Table 5. This is a very popular hunt for Unit 13 residents, shown by the high number of households getting permits. Harvests are low and have been relatively stable the last 5 years with no trend evident. Because the amount of federal land open for this hunt is extremely limited, accounting for 1–2% of the moose habitat in GMU 13, the fact that the federal harvest accounts for up to 9% of the unitwide moose harvests leads to the speculation that a number of moose claimed under the federal hunt are actually taken on state lands.

A state subsistence moose hunt (TM300) with 150 permits issued for any bull was initiated in 1995, with permits allocated under the Tier II permitting system. The harvest in 2002 was 54 bulls (Table 5). Since its inception, the harvest has doubled and the hunter success rate increased from 22% to 42%. This hunt is becoming more important to permit holders as moose numbers decline. Of the total unit moose harvest, this subsistence harvest has gone from 3% in 1995 to 10% in 2002. Given the any bull regulation, antler composition data from this harvest show a smaller average size of harvested bulls than those taken under the general hunt. Due to the variation in size and limited number of moose harvested in this hunt, this harvest has little influence on age composition of bulls remaining after the subsistence hunting season. The general hunt begins the day after the subsistence hunt closes.

Illegal Harvests. Unreported and illegal harvest estimates are presented in Table 3. The estimate for the illegal take is high, (and I believe could exceed 10% of the reported harvest) because of the spike-fork/50-inch regulation. A number of yearlings taken and reported as forks may actually be illegal because of the difficulty distinguishing small paddles and palms from forks. Also, I believe numerous sub-50-inch bulls are harvested because few hunters can reliably tell a 50-inch bull from a 45-inch bull in the field. This assumption is based on 9 years of field experience monitoring this hunt, as well as Alaska Bureau of Wildlife

Enforcement case reports. Many of the illegal bulls taken are initially misidentified as legal by the hunter. Once an illegal bull is taken, I believe most are subsequently reported as legal. This increased illegal harvest is important because it often comes from heavily hunted areas where very few legal bulls remain. Fall sex composition data support the assumption that the illegal take is high because current bull:cow ratios in some areas, such as CA-6 (Clearwater Creek in 13B), are lower than expected given the number of bulls that should be protected under a spike-fork/50-inch regulation.

Hunter Residency and Success. Local residents of Unit 13 accounted for 10–12% of the moose harvested under the general season, according to harvest ticket returns (Table 4). Before the season closed to nonresident moose hunters, they averaged 10% of the unitwide moose harvest.

The success rate for moose hunters in the Unit 13 general hunt was 13% in 2001, down from the 16–17% observed between 1996 and 1999 (Table 4). Hunter success for the 10-year period before 1993 averaged 24%. The hunter success rate in 2002 for the Tier II subsistence permit hunt was 42%, and 7% for the federal subsistence hunt in 2001 (Table 5). Successful moose hunters in the general hunt reported spending an average of 7.7 days hunting in 2003 for all of the reporting period. In 1989 harvest ticket returns show that 3556 hunters reported an average of 5.9 days hunting for a total of 21,240 days hunting moose in Unit 13. Hunting effort peaked in 1995 when 5483 hunters spent an average of 10.2 days hunting, for a total of 55,938 days afield. By 2003 hunting effort had declined to approximately 21,169 days afield.

Harvest Chronology. Chronology data for the general hunt are presented in Table 6. The last 2 weeks of the season have accounted for more than half the harvest in every year since 1994. This harvest pattern is predictable because moose are more vulnerable later in September. Leaf fall starts occurring at this time and onset of the rut initiates calling and increased bull movements.

Transport Methods. During the last 5 years, 4-wheelers have been the most important method of transportation (Table 7). It is obvious that Unit 13 is an important 4-wheeler and off-road vehicle (ORV) area for moose hunters. In the last 2 years, those using either 4-wheelers or ORVs are the largest group of hunters and have averaged approximately 60% of the total moose harvest. As a group, aircraft and ORV users (other than 4-wheelers) have the highest rate of success, while those using 4-wheelers have a lower success rate.

Other Mortality

Brown bears are abundant in Unit 13 and are important predators of neonatal moose calves, taking up to 50% of the calves born within the first 6 weeks of life (Ballard et al. 1981). Although brown bears kill adult moose, the rate is much lower than calves. Because bears kill so many calves, a reduction in bear predation can result in increased calf survival that is carried over as spring recruitment (Ballard et al. 1987). Wolf numbers in Unit 13 started increasing in 1990. The fall 1998 and 1999 unitwide estimates exceeded 500 wolves (11.7 wolves/1000km²), the highest in more than 25 years. In the 13A west study area, the fall 1999 moose-to-wolf ratio was 32:1. This ratio is so low that wolf predation alone could result in a decline in the moose population, especially because in Unit 13 wolves continue to take moose

even when caribou are present (Ballard et al. 1987). Wolf numbers declined slightly in 2002 following 2 years of heavy wolf harvests, with a preliminary fall estimate of 420 wolves.

The winter severity index between 1998 and 2003 shows the last 2 winters were very mild. The unitwide winter severity index is based on snow depths from 17 snow courses throughout the unit. The winter of 1999–2000 was severe and is the second worst winter recorded. Spring 2000 surveys suggest increased mortality resulted from deep snow conditions, especially in 13A and E, which had record snow depths. The winter of 2000–01 was considered an average winter. Observations of winter mortality in Unit 13 over the years have led to the conclusion that moose mortality due to deep snow conditions has not been density dependent. Instead, there appears to be a threshold effect triggering increased calf mortality once snowfall reaches about 30 inches in depth. As the snow pack increases, yearlings, then adult bulls, and finally adult cows die, regardless of moose densities. In addition to killing moose, deep snows often make it easier for wolves to take moose, which increases predation mortality. Overwinter survival during the mild winter of 2002–03 was thought to be quite good because of the increase in yearling bulls observed during the fall 2003 moose counts.

HABITAT

Assessment

Unit 13 has numerous areas where habitat improvement could produce more favorable browse conditions for moose. Because of the size and remoteness of much of the unit, wildfire is considered the only feasible tool for extensive habitat improvement. Wildfires occurred throughout much of Unit 13 before 1950, when fire suppression activities were initiated. Since then, negligible acreage has burned. Current fire suppression policies in the Copper River Fire Management Plan set aside large portions of the unit as let-burn areas where wildfires will not be suppressed. However, this plan has often been ignored and some wildfires have been suppressed, even if they occurred in an area designated as limited suppression. The current level of fire suppression has resulted in fewer fires and reduced seral habitat available as moose browse. The effect has been to lower the moose carrying capacity over extensive portions of Unit 13. Because of the lack of fire-created seral plant communities, climax upland and riparian willow communities are the most important habitat types for moose in the unit.

Evaluation of browse in important moose areas from 1983 to 1986 indicates browse species were able to withstand the level of use occurring at that time. Research continues on evaluating available browse and use by moose in 13A as part of an ongoing moose research project. Preliminary indications are that current browse use rates are sustainable (Collins 1997).

The use of prescribed fires to replace wildfires as a method of improving moose habitat has had very little success in Unit 13. The climate in Unit 13 typically limits the use of prescribed fire in the driest years, when the danger of an escaped fire increases. Also, scattered cabins and private land ownership in Unit 13 have increased over the years and increase the liability associated with the use of prescribed fire. In spite of problems associated with controlled burns, work with BLM and DNR is ongoing, and a prescribed fire was attempted in 2003. The Alphabet Hills controlled burn was ignited, but the weather changed suddenly and only 5000

acres were burned. The area burned was around Kelly Lake on the south slopes of the Alphabet Hills in Unit 13B. This area was also lit in 1984, but the fire did not carry because it was too late in the season and ground moisture was too high. Plans call for additional ignition attempts, should the fire prescription again be met.

Habitat improvement by mechanical methods such as crushing is an alternative to burning. To be effective, mechanical treatment must be done on riparian habitats where moose concentrate during critical winter months. However, mechanical treatment is expensive, and the cost limits mechanical treatment to small but important concentration areas near the road system where access for heavy equipment is available. One such small site was crushed in 1993, and initial regeneration of willows was good. Additional sites for mechanical treatment have been identified along the Copper River in Unit 13C where moose winter during deep snow years. Work continues toward gaining permission from landowners to crush this area.

Low densities of moose and an annual twinning rate of up to 30% indicated habitat is adequate for population growth if predation pressure could be decreased.

CONCLUSIONS AND RECOMMENDATIONS

Changes in moose-per-hour rates during fall moose counts indicate that unitwide moose abundance declined between 1994 and 2001. Census data from 1994, and 1998–2001 indicate a 50% decline has occurred in Unit 13A. Declines occurred in all sex and age classes.

Moose count data for fall 2002 are incomplete because of a lack of snow. Some count areas were not surveyed and conditions were only fair in those surveyed. As a result of the late counts and only fair survey conditions, moose-per-hour figures are not as useful in determining population trends for 2002. Changes in moose-per-hour rates during fall moose counts indicate a unitwide moose abundance decline between 1994 and 2001. This trend is supported by a 50% decline in the 13A moose population based on census data collected between 1994 and 2001. The moose-per-hour estimate for 2003 suggests an increase in moose population between 2001 and 2003.

The calf:cow ratios observed during fall sex and age composition counts between 1998 and 2001 are the lowest ever observed in GMU 13. These ratios are 25–30% below levels observed between 1978 and 1988, when moose were increasing. The calf:cow ratio increased in 2002 and was the highest in 6 years. Although count conditions in 2002 were poor, the sample size was large enough and evident across multiple count areas, so the increase in calf:cow ratio could be accepted as a real event. Calf:cow ratios declined in 2003. Low calf:cow ratios are attributed to poor calf survival, as calf production has changed little over 26 years, based on pregnancy and birth rates for radiocollared cows that approach those observed in GMU 13 during periods of population growth. Twinning rates for moose in GMU 13 fluctuate between years and subunits, probably due mostly to small sample size, and are typical of an Interior Alaska moose population on mature range. Population modeling suggests that the GMU 13 moose population will decline in years when fall calf:cow ratios approach only 15 calves:100 cows.

The bull:cow ratio has increased over this reporting period. The 2003 bull:cow ratio was the highest in 10 years. The 2002 bull:cow ratio was higher but was considered incomplete because 2 of the heaviest hunted count areas, which generally have the lowest bull:cow ratios, were not surveyed. A breakdown of the bull:cow ratio for 2003 shows 8 yearling bulls:100 cows and 16 large bulls:100 cows, compared to 3 yearling bulls:100 cows and 18 large bulls:100 cows in 2001. The data suggests overwinter survival in 2002–03 was high for calves, and much of the higher calf crop in 2002 was recruited into the population. It also suggests that current harvests of large bulls meet or exceed recruitment into the large bull segment of the population, and current harvests are as high as can be supported by the average yearly recruitment.

The Unit 13 moose population increased slightly during the last 2 years of this reporting period. Two important factors contribute to this change: increased calf survival and overwinter moose survival. The winters of 2001–02 and 2002–03 were very mild, both in snowfall and temperature. During mild winters, there is little natural mortality, and predation rates decline as wolves have a more difficult time killing moose. The wolf population also declined by as much as 20% following record-high wolf harvests. The poorest fall calf:cow ratios occurred in years with the highest wolf estimates. Also, high wolf numbers in years with deep snow conditions resulted in higher overwinter loss to wolves.

Modeling suggests the moose population will again start to decline despite one year of lower wolf numbers and increased recruitment seen in 2002. Based on fall 2003 moose surveys and wolf estimates, wolf numbers appear to be increasing and calf survival has declined. Even if the winter of 2003–04 is mild to moderate, calf numbers going into the winter may not be high enough to allow unitwide population growth in the face of higher wolf predation.

Harvest and hunting effort figures indicate a large decline in both the number of moose harvested and the number of individuals reporting hunting. Unit 13 once was one of the most important moose hunting units in the state, and in the late 1980s the harvest was one of the highest in the state.

LITERATURE CITED

- BALLARD, W. B., T. H. SPRAKER, AND K. P. TAYLOR. 1981. Causes of neonatal moose calf mortality in south-central Alaska. *Journal of Wildlife Management* 45(2):335–342.
- , J. S. WHITMAN, AND C. L. GARDNER. 1987. Ecology of an exploited wolf population in Southcentral Alaska. *Wildlife Monographs* 98. 54pp.
- COLLINS, WILLIAM B. 1997. Interrelationship of forage and moose in Game Management Unit 13. Federal Aid in Wildlife Restoration Progress Report, Project W-24-5. Study 1.50. Juneau, Alaska USA.
- TESTA, J. W. 1997. Population dynamics of moose and predators in Game Management Unit 13. Federal Aid in Wildlife Restoration. Progress Report. Grant W-24-5. Study 1.49. Juneau, Alaska USA.

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Table 1 Unit 13 fall aerial moose composition counts and estimated population size, 1998–2003.

Year	Bulls: 100 cows	Yearling bulls: 100 cows	Calves: 100 cows	Calves %	Adults	Total moose observed	Moose /hour	Density moose mi ² (range)
1998–99	18	4	14	11	4904	5496	46	1.3 (0.5–4.9)
1999–00	21	4	14	11	4234	4738	46	1.1 (0.2–1.8)
2000–01	20	3	12	9	4000	4382	38	1.0 (0.8–4.4)
2001–02	21	3	15	11	3948	4444	35	1.0 (0.5–4.5)
2002–03	27	7	23	16	2098	2485	33	1.0 (0.5–1.9)
2003–04	24	8	18	12	3902	4457	49	1.3 (0.5–5.0)

Table 2 Unit 13 fall aerial moose composition counts, 2003.

Unit	Bulls: 100 Cows	Yearling Bulls:100 Cows	Calves: 100 Cows	Calves %	Total Moose Observed	Moose /hour	Density moose mi ² (range)
13A	22	10	19	13	1337	60	1.4
13B	22	6	17	12	1943	44	1.3
13C	21	8	24	17	393	50	1.7
13D	71	4	14	8	180	22	0.5
13E	27	12	11	8	377	49	0.9

Table 3 Unit 13 moose harvest^a and accidental death, 1998–2003.

Regulatory year	Reported				Estimated			Accidental			Grand Total
	M	F	U	Total ^b	Unreported	Illegal	Total	Road	Train ^c	Total	
1998–99	913	5	20	938	25	25	50	50	14	64	1052
1999–00	814	1	9	824	25	25	50	50	76	126	1000
2000–01	550	3	9	562	25	25	50	50	20	70	682
2001–02	463	0	5	468	25	25	50	50	3	53	571
2002–03	571	0	3	574	25	25	50	50	1	51	675

^a Includes permit hunt harvest, harvest tickets and federal subsistence hunts.

^b Includes unknown sex.

^c 13E – the Alaska Railroad.

Table 4 Unit 13 moose hunter residency and success for general harvest ticket hunt only, 1998–2003.

Regulatory Year	Successful				Unsuccessful				Total Hunters
	Local ^a Resident	Nonlocal Resident	Non- resident	Total ^b	Local ^a Resident	Nonlocal Resident	Non- resident	Total ^b	
1998–99	66	697	91	860	410	3523	124	4083	4943
1999–00	77	551	86	722	418	3123	151	3722	4444
2000–01	39	386	47	477	362	2527	116	3036	3513
2001–02	44	312	37	395	349	2072	78	2543	2938
2002–03	54	407	2	466	315	1898	11	2239	2705

^a Residents of Unit 13

^b Includes unspecified residency

Table 5 Unit 13 moose harvest data for permit hunts, 1998–2003.

Hunt Number	Regulatory year	Permits issued	Percent Did not Hunt	Percent Unsuccessful Hunters	Percent Successful Hunters	Bulls	Cows	Unknown	Harvest
State Tier II TM300	1998–99	150	17	71	29	37	0	1	38
	1999–00	150	17	70	30	35	0	--	35
	2000–01	150	9	68	32	40	0	--	40
	2001–02	150	11	72	28	35	0	--	35
	2002–03	150	8	58	42	54	0	--	54
Federal Subsistence									
BLM									
RM313/314	1998–99	557	29	89	11	41	0	0	41
	1999–00	828	29	86	14	67	0	0	67
	2000–01	800	32	91	9	45	0	0	45
	2001–02	935	34	93	7	38	0	0	38
	2002–03	N/A							

Table 6 Unit 13 moose harvest chronology percent by week for general harvest ticket hunt, 1998–2003.

Regulatory Year	Season dates	Week of Season					<i>n</i>
		1 st	2 nd	3 rd	4 th	5 th	
1998–99	20 Aug–20 Sep	13	11	21	30	24	834
1999–00	1 Sep–20 Sep	7	33	33	28		695
2000–01	1 Sep–20 Sep	7	37	39	17		445
2001–02	1 Sep–20 Sep	10	23	34	33		369
2002–03	1 Sep–20 Sep	8	26	34	32		449

Table 7 Unit 13 moose harvest percent by transport method for general harvest ticket hunt, 1998–2003.

Regulatory Year	Percent of Harvest								<i>n</i>	
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway Vehicle	Airboat		Unknown
1998–99	10	4	7	40	0	20	17	1	1	860
1999–00	11	3	9	41	0	20	14	1	2	722
2000–01	11	4	6	42	0	19	16	1	1	477
2001–02	10	4	8	39	0	21	15	1	2	395
2002–03	9	1	10	46	0	20	12	0	2	466

MOOSE MANAGEMENT REPORT

From: 1 July 2001

To: 30 June 2003^a

LOCATION

GAME MANAGEMENT UNIT: 14A (2561 mi²)

GEOGRAPHIC DESCRIPTION: Matanuska Valley

BACKGROUND

Moose were scarce in the Matanuska Valley as “colonists” arrived and settled during the 1930s, but probably grew to numbers approaching 7000 during the 1960s (Griese 1996). Numbers fluctuated with deep snow winters, but stabilized between 5000 and 6000 animals in the 1990s. Habitat enhancement through agricultural activities and a 37,000-acre fire in the southwestern part of the unit allowed the population to increase to more than 6000 animals in the late 1990s.

Annual harvest levels in the first 12 years after statehood (1960–1971) ranged from 200–1300 (Griese 2000). The harvest was predominantly bulls, averaging 350 annually, but the harvest of antlerless moose was as high as 1131 in 1962–1963 (Griese 2000). Following severe winters antlerless moose seasons were discontinued from 1972 to 1977 and the mean annual harvest of bulls declined to 251 (range:167–346). Antlerless seasons began again in 1978, and from 1978 to 1998, the annual cow harvest ranged from 0 (1990) to 284 (1996). Harvest during the “any bull” period of 1979–1992 averaged 367 (range:201–530) (Griese 2000).

Starting in 1993, the bull harvest during the general season was restricted to moose with antlers having a spike or fork on at least 1 side or a minimum of 3 brow tines on at least 1 side or a minimum width of 50 inches. This selective harvest strategy is referred to as “spike/fork-50-inch” (SF50) (Schwartz et al 1992). Since 1993, the period with antler restrictions, the harvest averaged 342 (range:233–554).

The human population in the Matanuska/Susitna area continues to be one of the fastest growing in the state. Land clearing associated with settlements and road construction has been responsible for the growth of preferred moose browse. As the area continues to grow, much of the early seral moose habitat will be replaced with homes, roads, and associated industry. During the 1990s, motorists killed an average of 180 moose annually in the Matanuska/Susitna area. Since 2000 the average road kill has increased to 207.

^a This unit report also includes data collected outside the reporting period at the discretion of the reporting biologist.

Habitat enhancement efforts during the 1990s were aided by wildfires. In 1993 a successful cooperative effort between state agencies resulted in a 900-acre controlled burn to enhance wintering moose habitat near Willow (Collins 1996). In June 1996, a 37,000-acre fire burned in the Big Lake area (Griese and Masteller 1998). Even though the habitat enhancement from the Big Lake burn will greatly aid moose in the future, it politically restricted future prescribed burns. The Ruffed Grouse Society and the Department of Fish and Game have begun a 5–10 year habitat enhancement project in the Matanuska Valley Moose Range. Over 3 years, 275 acres of aspen forest were clearcut to produce early successional growth to benefit grouse and other species.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Maintain and enhance the moose population to provide for high levels of human consumptive use.
- Provide maximum opportunity to participate in hunting moose.
- Provide opportunities for nonconsumptive uses.

MANAGEMENT OBJECTIVES

- To maintain a posthunt population of 6000–6500 moose with a sex ratio of 20–25 bulls:100 cows.
- To achieve an annual hunter harvest of 360–750 moose.

METHODS

We conducted Becker surveys on 1–4 December 2000 and 23–27 October 2001 (Becker and Reed 1990). We generated a population estimate and age/sex statistics using MOOSEPOP (Becker and Reed 1990). During both surveys we attempted to categorize bulls' antler size and brow-tine configuration.

We surveyed a portion of the primary wintering habitat in Subunit 14A during early March 2000 and 2001 to quantify the percent of short yearlings in the population as an assessment of recruitment.

The harvest was monitored with harvest reports. Harvest data was reviewed for accuracy and updated if necessary. Some figures may not match those previously reported. The Alaska Railroad Corporation provided numbers of moose killed by trains, and the Department of Public Safety provided numbers of moose killed by highway vehicles or in defense of life or property. Age categories (calf, yearling, adult) and sex of moose from road and railroad mortalities were provided by charities receiving the meat.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The population increased between the fall survey in 2000 (5552 ± 571 ; 80% C.I.) and the fall survey in 2001 (6679 ± 453 ; 80% C.I.) and stabilized into 2003 (6564 ± 748) (Table 1).

Population Composition

We observed 19 bulls:100 cows in the fall of 2001 (Table 1). No surveys were flown in 2002; however, we observed 21 bulls:100 cows in 2003. We were at, or near, our objective levels (20–25 bulls:100 cows). Calves continued to display high overwinter survival during the report period (Table 2).

MORTALITY

Harvest

Season and Bag Limit. The fall season was 10–17 August for archery-only hunters with a 20 August–30 September general season for resident and nonresident hunters for both years. During this period the bag limit was one spike/fork-50 bull.

The department issued 50 drawing permits for antlerless moose for the 20 August–30 September season in 2001 and 400 permits in 2002.

During the past 10 years the moose harvest has fluctuated from 319 to 851 moose, depending on population status and the number of permit hunts. The bull moose harvest for the past 5 years has remained relatively consistent, averaging 336 moose (range of 313–376).

Any-bull permits were discontinued in 2000. The department issued 50 antlerless moose drawing permits for the northern Matanuska River area in 2001 resulting in a harvest of 30 cows (Table 4). The department increased the number of cow permits to 400 (harvest of 212) in order to keep moose population within objectives.

Board of Game Actions and Emergency Orders. During the spring 2001 Board of Game meeting the winter ‘spike-fork-only’ hunt was eliminated and the department informed the board of our intent to issue 50 antlerless moose drawing permits because the population exceeded the upper end of the previous population objective of 5500. The board increased the population objective to 6000–6500 and expanded the harvest objective from 600–700 to 360–750. This action came at the request of local advisory committees. The department also adjusted the potential allotment of antlerless permits from 600 down to 400.

At the spring 2003 meeting, the board considered several proposals to change moose hunting and the spike-fork/50 system, but no changes were approved.

Hunter Residency and Success. An average of 2950 people hunted in Unit 14A during the previous 5 years. Local residents of Unit 14 consistently make up the majority of the hunter composition, harvesting 92–97 percent of all moose taken in Unit 14A. Hunter success ranged 11–13 percent during the past 5 years (Table 5). Residency composition of hunters changed little from previous years.

Harvest Chronology. More moose are taken during the first week of the general season than any other period (Table 6). Generally, the next highest period of harvest was the last week of the general season, regardless of when that part of the season occurred.

Transport Methods. The elimination of the winter hunt in 2001–2002 eliminated the use of snowmachines as a transportation method (Table 7). Four-wheelers and highway vehicles have accounted for a majority of the transportation types used by successful hunters in the past 10 seasons (Table 7). In 1998 the department began tracking harvest by hunters from airboats. Since that time, 1 percent or less of the hunters have reported using airboats in GMU 14A. (Table 7).

Accidental and Illegal Mortality

Accidental human-caused moose mortality during the 5-year period 1998–2002 averaged 166 (range 130–252) moose killed by highway vehicles and 15 (range 2–34) by train (Table 3). Highway collisions appear to be increasing as a result of higher moose numbers and many more vehicles on valley roads. Winter weather only exacerbates the problem.

HABITAT

Enhancement

During the winter of 2001–02, the Ruffed Grouse Society and ADF&G conducted the first year of a multi-year project enhancing habitat in the Matanuska Valley Moose Range. To date, 275 acres of predominantly aspen forest have been cut.

CONCLUSIONS AND RECOMMENDATIONS

The new harvest objective was met in 2001 and 2002 (Table 3). The antlerless permits issued for both years helped achieve this objective. Harvest of antlerless moose is needed to maintain the population size at objective levels.

We believe effective intensive management in this subunit requires investigation into the distribution and movement of moose. Specifically, studies investigating the winter movement of moose into the Point MacKenzie agricultural project and the 1996 Big Lake burn area will reveal the proportion of the moose that are migratory and where the migratory individuals spend the nonwinter months. The Point MacKenzie winter population exceeds 10 moose/mi², one of the highest densities in the state. These areas are critical to moose in the unit and may be used by moose summering within adjacent units where moose populations have declined 30–40% in the past few years.

LITERATURE CITED

- BECKER E. F. AND D. J. REED. 1990. A modification of a moose population estimator. *Alces* 26:73-79.
- COLLINS W.B. 1996. Wildlife habitat enhancement in the spruce-hardwood forest of the Matanuska and Susitna River valleys. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration Final Research Report. Project W-23-5, W-24-1, W-24-2, W-24-3. Juneau, Alaska USA.

GRIESE H.J. 1996. Game Management Unit 14A moose survey-inventory progress report. Pages 117-130 *in* M. V. Hicks, ed. Survey-inventory management report: Moose. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Progress Report. Grants W-24-2 and W-24-3. Study 1.0. Juneau. 510 pp.

——— 2000. Game Management Unit 14A moose management report. Pages 140-154 *in* M. V. Hicks, ed. Federal aid in wildlife restoration management report survey-inventory activities, 1 July 1997–30 June 1999. Moose. Alaska Department of Fish and Game. Grants W-27-1 and W-27-2, Study 1.0. Juneau, Alaska USA.

——— AND M. MASTELLER 1998. Game Management Unit 14A moose management report. Pages 126-144 *in* M. V. Hicks, ed. Federal aid in wildlife restoration management report survey-inventory activities, 1 July 1995–30 June 1997. Moose. Alaska Department of Fish and Game. Grants W-24-4 and W-24-5, Study 1.0. Juneau, Alaska USA.

SCHWARTZ C.C., K.J. HUNDERTMARK, AND T.H. SPRAKER. 1992. An evaluation of selective bull moose harvest on the Kenai Peninsula, Alaska. *Alces* 28:1-14.

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Table 1 Unit 14A fall aerial moose composition surveys and censuses, 1991–2003

Regulatory Year	Bulls: 100 Cows	Yearling Bulls: 100 Cows	Calves: 100 Cows	Calves(%)	Adults Observed	Moose Observed	Moose /mi ²	Estimated Population Size
1991–92 ^a	14	5	39	26	1110	1472	3.7	5885±706 ^b
1992–93 ^c	9	6	40	27	697	934	n/a	5200–6200 ^b
1993–94 ^d	16	11	37	24	942	1232	3.6	5672±798 ^b
1994–95 ^c	21	8	35	22	1098	1398	n/a	5500–6500
1995–96 ^e	--	--	--	--	--	--	--	5000–5500
1996–97 ^f	23	6	42	25	1696	2290	n/a	5500–6500
1997–98 ^g	14	5	30	21	611	774	n/a	5000–6000 ^b
1998–99 ^h	17	7	33	22	1191	1509	3.0	4729±530 ^b
1999–00 ^h	19	10	37	24	1021	1317	3.4	5348±721 ^b
2000–01 ^h	18	7	37	19	1300	1693	3.5	5552±571 ^b
2001–02 ^h	19	8	34	22	1781	2301	4.2	6679±453 ^b
2002–03 ^e								
2003–04 ⁱ	21	9	29	19	1869			6564+748 ^b

^a Gasaway et al (1986) survey^b 80% confidence interval^c Sampling of 1991 surveyed units (Griese and Masteller,1996)^d Becker survey^e No surveys^f Combined results of Matanuska River drainage east of Moose Creek and composition surveys in CAs 1–7 & Pt. MacKenzie^g Incomplete Becker survey due to antler drop^h Modified Becker survey (nonrandom sampling but duplication of 1991 sampling units)ⁱ Ver Hoef Spatial Estimator Survey method

Table 2 Unit 14A late winter aerial moose composition surveys, 1990–2003

Regulatory year	Date	Count areas	Total moose	Calves ^a	Percent calves
1990–91	03/04–11	5,6 & 8	1348	167	12
1991–92	02/25	7	121	26	21
	04/10	3-6 & 8	546	76	14
1992–93	03/24	4-8	693	131	19
1993–94	03/05–09	4-8	981	175	18
1994–95	04/03–04	4-8 & Pt. MacKenzie	518	75	14
1995–96	03/28	6 & Pt. MacKenzie	471	85	18
1996–97	04/08–09	5,6, 8 & Pt. MacKenzie	226	53	23
1997–98	no surveys				
1998–99	03/12–15	4-8 & Pt. MacKenzie	1178	201	17
1999–00	03/08–10	1,2,4-8 & Pt. MacKenzie	1291	222	17
2000–01	03/26–04/02	1-8 & Pt. MacKenzie	633	120	19
2001–02	03/28–29	1,3,5-8 & Pt. MacKenzie	899	148	16
2002–03	no surveys				
2003–04	04/14	6,8	80	25	31

^a Calves = short yearlings

Table 3 Unit 14A moose harvest^a and accidental death, 1990–2003

Regulatory year	Reported				Estimated		Total	Accidental deaths ^e			Grand total
	M	F	Unk	Total ^b	Unreported ^c	Illegal ^d		Road	Train	Total	
1990–91	258	0	1	259	13	35	48	140	22	162	469
1991–92	490	41	5	536	25	25	50	166	15	181	767
1992–93	530	155	7	692	27	30	57	132	7	139	888
1993–94	233	204	1	438	12	40	52	166	18	184	674
1994–95	281	241	9	531	14	60	74	260	39	299	904
1995–96	335	127	8	470	23	50	73	85	11	96	639
1996–97	555	288	8	851	39	50	89	185	17	202	1142
1997–98	489	251	5	745	34	55	89	168	16	184	1018
1998–99	376	208	6	590	26	55	81	134	15	149	820
1999–00	323	0	9	332	23	60	83	181	34	215	630
2000–01	313	1	5	319	22	60	82	133	7	140	541
2001–02	345	31	7	383	24	60	84	252	15	267	734
2002–03	325	215	1	541	23	60	83	130	2	132	756

^a Includes permit hunt harvest

^b Includes moose of unknown sex

^c Derived by taking 7% of the reported harvest of bulls, 5% prior to 1995.

^d Includes moose taken in defense of life or property, enforcement cases and an estimate of out-of-season take

^e Road and train kills are minimum numbers

Table 4 Moose harvest data by permit hunts in Unit 14A, 1990–2003

Hunt	Regulatory year	Applicants	Permits issued	Percent ^a did not hunt	Percent ^a unsuccessful hunters	Percent ^a successful hunters	Bulls	Cows	Total
DM411 (Any bull–early fall)									
	1995–96	1521	70	16	54	29	20	0	20
	1996–97	1978	100	10	53	37	37	0	37
	1997–98	1414	50	6	70	24	12	0	12
	1998–99	1463	50	16	52	28	14	0	14
	1999–00 ^b	--	0	--	--	--	--	--	--
DM412 (Any bull – late fall)									
	1995–96	1078	20	5	35	60	12	0	12
	1996–97	1235	30	4	11	80	24	0	24
	1997–98	1162	20	20	25	55	11	0	11
	1998–99	1200	20	10	45	45	9	0	9
	1999–00 ^b	--	0	--	--	--	--	--	--
DM418 (Antlerless - late fall)									
	1993–94	3760	70	13	40	47	3	30	33
	1994–95	5464	100	10	13	76	5	71	76
	1995–96	4781	70	14	31	54	2	36	38
	1996–97	3866	70	14	0	86	2	58	60
	1997–98	3252	70	4	20	76	0	53	53
	1998–99	3740	70	11	49	40	2	26	28
	1999–00 ^b	---	0	---	---	---	---	---	---

Table 4 Continued

Hunt	Regulatory year	Applicants	Permits issued	Percent ^a did not hunt	Percent ^a unsuccessful hunters	Percent ^a successful hunters	Bulls	Cows	Unk	Total
DM419 & 420 (Antlerless—early fall)										
	1990–91	0	0	---	---	---	---	---	0	---
	1991–92	7057	100	13	48	39	0	39	0	39
	1992–93	11,000	400	12	49	39	3	152	0	155
	1993–94	10,390	400	10	44	45	4	174	0	179
	1994–95	11,185	400	10	46	44	4	169	1	174
	1995–96	10,075	200	7	48	46	1	90	0	91
	1996–97	10,447	500	8	44	46	4	225	3	232
	1997–98	8675	450	8	48	44	1	195	1	197
	1998–99	9230	400	8	46	46	1	181	0	182
	1999–00 ^b	---	0	---	---	---	---	---	--	---
DM409 (Antlerless-N. Matanuska River Area)										
	2001–02	4803	50	8	32	60	0	30	0	30
DM400—DM410 Antlerless early fall										
	2002–03	16,594	400	9	36	55	9	212	0	221
	2003–04	14,852	320	8	34	55	2	174	0	176

^a Percent of permits issued^b Discontinued hunt^c DM409 initiated in 2001^d DM400—DM410 initiated in 2002

Table 5 Unit 14A moose hunter residency and success ^a, 1990–2003^b

Regulatory year	Successful					Unsuccessful					Total hunters
	Local ^c resident	Nonlocal resident	Nonres.	Unk.	Total (%)	Local ^c resident	Nonlocal resident	Nonres.	Unk.	Total (%)	
1990–91	242	3	8	6	259 (14)	1466	22	14	26	1528 (86)	1787
1991–92	471	11	9	6	497 (17)	2293	39	12	25	2369 (83)	2866
1992–93	499	11	12	15	537 (16)	2631	48	24	102	2805 (84)	3342
1993–94	217	4	1	4	226 (9)	2306	59	11	55	2431 (91)	2657
1994–95	273	6	1	1	281 (11)	2212	43	14	17	2286 (89)	2567
1995–96	292	11	2	3	310 (9)	3009	84	22	13	3128 (91)	3438
1996–97	475	11	11	1	498 (13)	3349	76	40	14	3479 (87)	3977
1997–98	441	21	5	5	472 (13)	3174	67	43	17	3301 (87)	3773
1998–99	329	13	11	3	356 (11)	2848	79	30	27	2984 (89)	3340
1999–00	314	8	5	4	332 (12)	2440	62	21	28	2551 (88)	2883
2000–01	295	14	7	3	319 (11)	2424	51	38	16	2529 (89)	2848
2001–02	327	13	11	2	353 (13)	2328	46	30	11	2415 (87)	2768
2002–03	297	11	12	0	320 (11)	2489	51	46	4	2590 (89)	2910

^a Does not include drawing permit hunters

^b All information in this table has been updated since last management report.

^c Unit 14 residents

Table 6 Unit 14A moose harvest chronology^a 1990–2003^b

Regulatory	August			September					November	December		Unknown ^c	Total
year	10–17	20–26	27–31	1–7	8–14	15–20	21–25	26–30	20–30	1–7	8–15		
1990–91 ^c	--	--	--	211	36	--	--	--	--	--	--	12	259
1991–92 ^d	--	--	--	253	109	107	--	--	--	--	--	28	497
1992–93 ^d	--	--	--	255	118	143	--	--	--	--	--	21	537
1993–94 ^e	--	73	16	23	37	67	--	--	--	--	--	10	226
1994–95 ^e	--	61	30	47	41	84	--	--	--	--	--	18	281
1995–96 ^f	3	67	20	45	31	45	--	--	41	8	26	22	308
1996–97 ^f	8	85	20	41	50	67	--	--	132	30	39	26	498
1997–98 ^f	3	86	22	35	42	61	--	--	111	41	51	20	472
1998–99 ^f	2	68	23	41	39	56	--	--	45	21	45	16	356
1999–00 ^g	6	57	14	32	25	44	53	--	--	36	52	13	332
2000–01 ^g	4	67	20	38	30	43	24	--	--	27	55	11	319
2001–02 ^h	10	61	28	36	43	48	46	68	--	--	--	13	353
2002–03 ^h	6	70	19	32	35	51	44	53	--	--	--	10	320

^a Does not include drawing permit hunts^b All information in this table has been updated since last management report.^c Includes all harvest reported outside season dates.^c Open season = Sep 1–10^d Open season = Sep 1–20^e Open season = Aug 20–Sep 20 (SF/50 –“spike-fork/50-inch”)^f Open season = Aug 10–17 (Archery only), Aug 20–Sep 20 (Gen.SF/50), Nov 20–Dec 15 (SF)^g Open season = Aug 10–17 (Archery only), Aug 20–Sep 25 (Gen.SF/50), Dec 5–Dec 15 (SF)^h Open season = Aug 10–17 (Archery-only), Aug 20–Sep 30 (Gen.SF/50)

Table 7 Unit 14A percent transport methods of successful moose hunters^a, 1990–2003

Regulatory year	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Unk.	Airboat	Sample size
1990–91	7	7	12	22	0	10	35	7		259
1991–92	4	4	12	24	0	12	38	6		497
1992–93	4	5	13	22	0	7	43	5		537
1993–94	4	5	12	23	0	8	42	6		226
1994–95	5	3	13	26	0	7	39	6		281
1995–96	2	3	10	29	1	6	41	7		308
1996–97	2	3	7	22	16	7	40	4		498
1997–98	3	3	6	28	18	4	35	3		472
1998–99	4	4	7	35	6	5	33	5	1	356
1999–00	3	2	12	29	7	6	36	3	1	332
2000–01	3	2	9	34	8	4	36	3	1	319
2001–02	5	1	10	37	0	7	36	3	1	353
2002–03	6	3	13	36	0	5	32	5	1	320

^a Does not include drawing permit hunts

^b All information in this table has been updated since last management report.

MOOSE MANAGEMENT REPORT

From: 1 July 2001

To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 14B (2152 mi²)

GEOGRAPHIC DESCRIPTION: Western Talkeetna Mountains

BACKGROUND

The first comprehensive moose survey in Subunit 14B in the fall of 1987 estimated moose numbers at 2814 ± 248 (80% CI) (Masteller 1995). The population declined about 35% following the deep snow winter of 1989–90 (Masteller 1995). By the fall of 1994 the population recovered to an estimated 2336 ± 527 (80% CI), but another severe winter in 1994–95 caused high mortality levels (Masteller 1998). The last survey, conducted in the fall of 1999, estimated the population at 1687 ± 244 , (80% CI) indicating the population had not yet recovered.

The moose harvest has decreased since the 1970s and 1980s. Hunter harvests averaged 96 and 259 moose during the 1970s and 1980s, respectively. Liberal cow seasons allowed peak harvests to reach 372 moose in 1971, 534 in 1984, and 347 moose in 1987 (Griese 1993). With the decline in moose populations, the annual harvest average during the 1990s dipped to 58 moose. Slightly higher harvests have been reported since. Starting in 1993, the bull harvest during the general season was restricted to moose with antlers having a spike or fork on at least 1 side or a minimum of 3 brow tines on at least 1 side or a minimum width of 50 inches. This selective harvest strategy is referred to as “spike-fork/50-inch” (SF50) (Schwartz et al 1992).

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Maintain and enhance the moose population to provide for high levels of human consumptive use.
- Provide maximum opportunity to participate in hunting moose.

MANAGEMENT OBJECTIVES

- Attain a population of 2500–2800 moose, with a sex ratio ≥ 20 bulls:100 cows during the rut.
- Achieve an annual harvest of 100–200 moose.

METHODS

We generated a population estimate in the fall of 1999 using the Gasaway et al. (1986) stratified random census technique. Surveys have not been conducted since.

The harvest was monitored with harvest reports. All harvest data was reviewed for accuracy and updated if necessary. Some figures may not match those previously reported. The Alaska Railroad Corporation provided numbers of moose killed by trains, and the Department of Public Safety provided numbers of moose killed by highway vehicles or in defense of life or property.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population size

The fall 1999 survey conditions were excellent. The resulting population estimate was 1687 ± 244 (80% CI) (Table 1). However, the winter of 1999–2000 had deep snow conditions that contributed to the highest number of road/railroad kills (100) since 1990 (Table 2). The moose population had decreased about 28% since the Becker survey of 1994 and was comparable to levels found in 1990 and 1992. The 2002 survey was canceled because of poor survey conditions. In 2003 management priority focused on Game Management Unit 16B, and the 14B survey was again postponed.

Population Composition

In our November 1998 survey, we observed 38 bulls and 11 calves:100 cows with 8% of the sampled population being calves (Table 1). The fall 1999 survey estimated 40 bulls and 21 calves:100 cows with 13% of the sampled population as calves (Table 1). The yearling bull:cow ratio was 10:100 in 1998 and 12:100 in 1999. We suspect the bull:cow ratios are probably lower due to the season extension, but well above the minimum objective of 20 per 100 cows.

MORTALITY

Harvest

Season and Bag Limit. The fall season opened 10–17 August for archery only with a general season 20 August–30 September for resident and nonresident hunters for both years. During this period the bag limit was 1 bull with a spike or fork antler on at least 1 side or with an antler spread at least 50 inches or 3 or more brow tines on at least 1 side (SF/50).

Reported harvest has decreased since 92 bulls were taken during 1996–97 (Table 2). Hunters harvested 67 moose in each of the past 2 years (Table 2). This is higher than the previous 10-year average of 58, but still substantially lower than the historic highs reported in the 1980s.

Board of Game Actions and Emergency Orders. In response to declining moose numbers and the public desire to eliminate permit hunts, the board eliminated the 5–15 December winter hunt in 14B, and eliminated the any-bull permits (DM416). To replace some of the lost hunting opportunities, the general open season was extended 5 days to close 30 September.

At the spring 2003 meeting, the board considered several proposals to change moose hunting and the SF/50 system, but approved no changes.

Hunter Residency and Success. Residents of Unit 14 consistently make up the majority of the hunters (Table 3). The number of hunters has been relatively consistent in the past 5 years,

ranging between 426 and 546 hunters (Table 3). Hunting success rates during the past decade range between 9 and 16%.

Harvest Chronology. The extended season accounted for 23 animals taken in 2001–02 and 14 in 2002–03 (Table 4). The highest proportion of moose was taken during the last 10 days in each of the last 10 years. Only 1 animal was harvested during the archery-only season in the past 3 years.

Transport Methods. The elimination of the winter hunt in 2001–02 eliminated the use of snowmachines as a transportation method (Table 5). Four-wheelers and highway vehicles have accounted for a majority of the transportation types used by successful hunters in the past 10 seasons (Table 5). In 1998 the department began tracking harvest by hunters from airboats. Since that time, 2% or fewer of the hunters have reported using airboats in Subunit 14B.

Other Mortality

Moose killed by auto/train collisions numbered 41 in 2001–02 and 13 in 2002–03 (Table 2). These numbers are at, or below, the 10-year average of 39 auto/train collisions with moose in Subunit 14B.

CONCLUSIONS AND RECOMMENDATIONS

Even before the severe winter of 1999–2000, the moose population was below the objective level of 2500–2800. It is unlikely the 2004 survey will find the population near the objective level. The average annual harvest by hunters for the last 5 years was 68, below the objective of 100–200. Hunter harvest is unlikely to reach 100 moose unless access opportunities substantially increase, or the moose population increases.

The SF/50 regulation was adopted for Subunit 14B because it shared common boundaries with Units 16, 13 and 14A. Annual movements often carry moose across borders of Units 13E, 16A, 14A, and 14B (Modafferi 1999). Therefore, management decisions for Unit 14B should be made in conjunction with neighboring units. Concern for enforcement of the antler restriction along the boundary and the concern for false reporting were also reasons for inclusion in the program. SF/50 ensures that some bulls remain in the breeding population in heavily accessed areas (i.e. along highways and near communities).

LITERATURE CITED

- GASAWAY, W. C., S. D. DUBOIS, D. J. REED, AND S. J. HARBO. 1986. Estimating moose population parameters from aerial surveys. University of Alaska, Institute of Arctic Biology. Alaska Department of Fish and Game. Biological papers No. 22. Fairbanks, Alaska USA.
- GRIESE, H. J. 1993. Unit 14B moose survey-inventory progress report. Pages 126–135 in S. M. Abbott, editor. Moose survey and inventory management report, 1 July 1989–30 June 1991. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Grants W-23-3 and W-23-4, Study 1.0. Juneau, Alaska USA.

- MASTELLER, M. A. 1995. Unit 14B moose survey-inventory progress report. Pages 131–142 *in* M. Hicks, editor. Moose survey and inventory management report, 1 July 1991–30 June 1993. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Grants W-24-1 and W-24-2. Study 1.0. Juneau, Alaska USA.
- . 1998. Unit 14B moose survey-inventory progress report. Pages 145–154 *in* M. Hicks, ed. Moose survey and inventory management report, 1 July 1995–30 June 1997. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Grants W-24-4 and W-24-5, Study 1.0. Juneau, Alaska USA.
- MODAFFERI, R. D. 1999. Lower Susitna Valley moose population identity and movement study. Alaska Department of Fish and Game. Federal Aid Wildlife Restoration Research Final Report. Grant W-22-5–W-24-3, Study 1.38. Juneau, Alaska USA.
- SCHWARTZ, C.C., K.J. HUNDERTMARK AND T.H. SPRAKER. 1992. An evaluation of selective bull harvest on the Kenai Peninsula, Alaska. *Alces* 28:1-13.

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Table 1 Unit 14B fall aerial moose composition surveys, 1992–2003

Regulatory year	Bulls: 100 cows	Yearling bulls: 100 cows	Calves: 100 cows	Calves (%)	Adults observed	Moose observed	Observable moose/mi ²	Population estimate ($\pm 80\%$ CI)
1992–93 ^a	27.2	4.4	21.7	14.5	580	659	1.5	1582 \pm 178
1993–94 ^b	--	--	--	--	--	--	--	--
1994–95 ^c	31.1	8.2	17.3	12.0	862	969	2.2	2336 \pm 527
1995–96 ^b	--	--	--	--	--	--	--	--
1996–97 ^b	--	--	--	--	--	--	--	--
1997–98 ^b	--	--	--	--	--	--	--	--
1998–99 ^d	37.5	9.5	11.1	7.5	407	440	--	--
1999–00 ^e	40.2	12.3	21.3	13.2	616	699	1.6	1687 \pm 244
2000–01 ^b	--	--	--	--	--	--	--	--
2001–02 ^b	--	--	--	--	--	--	--	--
2002–03 ^b	--	--	--	--	--	--	--	--

^a Data from "Becker Surveys" conducted in November. SCF estimated at 1.40, 1.35 and 1.25 for low, medium, and high density strata, respectively.

^b No surveys conducted.

^c Data from "Becker Surveys" conducted in late October–early November. SCF estimated at 1.00, 1.41 and 1.00 for low, medium and high density strata, respectively.

^d High-grade sex and age composition survey conducted 20 November 1998.

^e Data from "Gasaway Surveys" conducted in late October–early November. SCF estimated at 1.20, 1.33, 1.15, and 1.03 for low, medium, high, and s-high density strata, respectively.

Table 2 Unit 14B annual moose harvest (general open season plus permit hunts) and accidental death tally, 1992–2003^a

Regulatory year	Reported				Estimated			Accidental ^d			Grand Total
	M	F	Unk	Total	Unreported ^b	Illegal ^c	Total	Road	Train	Total	
1992–93	34	0	0	34	2	5	7	10	24	34	75
1993–94	30	0	1	31	3	15	18	15	13	24	73
1994–95	36	0	0	36	4	15	19	34	57	91	146
1995–96	55	0	0	55	5	20	25	6	21	27	107
1996–97	92	0	0	92	9	20	29	10	7	17	138
1997–98	72	2	0	74	7	20	27	13	14	27	128
1998–99	78	3	0	81	8	20	28	16	18	34	143
1999–00	65	0	2	67	7	20	27	21	80	101	195
2000–01	56	0	0	56	6	20	26	14	7	21	103
2001–02	66	0	1	67	7	20	27	31	10	41	135
2002–03	67	0	0	67	7	20	27	13	0	13	107

^a All information in this table has been updated since last management report.

^b Derived by taking 5% of the total reported kill prior to SF50 (1993) and 10% after 1993.

^c Includes moose taken in defense of life or property.

^d Road and train are minimum numbers. Road kills do not include unsalvageable animals.

Table 3 Unit 14B moose hunter residency and success for the general open season, 1992–2003^a

Regulatory year	Successful					Unsuccessful					Total hunters
	Local ^b resident	Nonlocal resident	Nonres.	Unk.	Total (%)	Local ^b resident	Nonlocal resident	Nonres.	Unk.	Total	
1992–93	31	0	3	0	34 (11)	259	10	5	6	280	314
1993–94	28	1	2	0	31 (9)	285	3	2	7	297	328
1994–95	35	0	1	0	36 (11)	290	8	3	4	305	341
1995–96	36	1	2	3	42 (9)	413	12	5	11	441	483
1996–97	56	2	3	0	61 (11)	475	12	9	2	498	559
1997–98	43	1	5	0	49 (10)	393	18	9	2	422	471
1998–99	55	2	4	0	61 (13)	397	12	12	4	425	486
1999–00	44	2	4	1	51 (9)	459	12	13	11	495	546
2000–01	40	3	4	1	48 (10)	420	20	14	3	457	505
2001–02	61	3	3	0	67 (16)	330	13	13	3	359	426
2002–03	57	4	6	0	67 (14)	368	8	23	2	401	468

^a All information in this table has been updated since last management report.

^b Unit 14 residents.

Table 4 Unit 14B moose harvest chronology for the general open season, 1992–2003^a

Regulatory year	<u>August</u>			<u>September</u>					<u>November</u>	<u>December</u>		Unknown	Total
	10–17	20–26	27–31	1–7	8–14	15–20	21–25	26–30	20–30	1–7	8–15		
1992–93 ^b	--	--	--	24	6	--	--	--	--	--	--	4	34
1993–94 ^c	--	5	2	5	6	12	--	--	--	--	--	1	31
1994–95 ^c	--	8	1	1	5	19	--	--	--	--	--	2	36
1995–96 ^d	2	3	0	4	9	13	--	--	2	2	7	0	42
1996–97 ^d	0	15	2	3	9	12	--	--	8	1	8	3	61
1997–98 ^d	1	7	1	6	11	9	--	--	3	3	5	3	49
1998–99 ^d	2	6	5	6	6	16	--	--	4	4	7	5	61
1999–00 ^e	0	6	2	3	5	14	9	--	--	3	7	2	51
2000–01 ^e	0	3	0	5	2	15	9	--	--	2	10	2	48
2001–02 ^f	0	10	0	4	6	6	15	23	--	--	--	3	67
2002–03 ^e	1	7	5	5	7	8	19	14	--	--	--	1	67

^a All information in this table has been updated since last management report.

^b Open season = Sep 1–10.

^c Open season = Aug 20–Sep 20 (SF/50 –“spike-fork/ 50-inch”).

^d Open season = Aug 10–17 (Archery-only), Aug 20–Sep 20 (Gen.SF/50), Nov 20–Dec 15 (SF-only).

^e Open season = Aug 10–17 (Archery-only), Aug 20–Sep 25 (Gen.SF/50), Dec 5–15 (SF-only).

^f Open season = Aug 10–17 (Archery-only), Aug 20–Sep 30 (Gen.SF/50).

Table 5 Unit 14B transport methods used by successful moose hunters during the general season, 1992–2003^a

Regulatory year	Percent of successful moose hunters								No.	
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Unk	Airboat	moose harvested
1992–93	26	0	0	41	0	15	15	3		34
1993–94	23	0	6	32	0	10	23	6		31
1994–95	8	6	6	36	0	14	25	6		36
1995–96	12	0	7	36	5	12	26	2		42
1996–97	12	0	5	32	20	6	22	5		61
1997–98	16	2	10	27	12	12	18	2		49
1998–99	8	2	3	36	15	10	20	5	2	61
1999–00	18	2	0	29	16	10	24	2	0	51
2000–01	8	0	2	27	17	19	23	2	2	48
2001–02	15	1	4	42	0	15	22	0	0	67
2002–03	7	0	7	46	0	9	27	3	0	67

^a All information in this table has been updated since last management report.

MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 14C (1912 mi²) and Portage and Placer River drainages in Unit 7
Geographic Description: Anchorage area

BACKGROUND

Moose were uncommon in the Anchorage area before the 1940s. They increased in the late 1940s as brushy regrowth replaced mature forests cut or burned during the development of Anchorage and the Fort Richardson Military Reservation. Numbers increased considerably during the early 1950s, and by the late 1950s and early 1960s moose were abundant. The moose population has remained high during the past 4 decades.

Prime browse occurs in open-canopied, second-growth willow, birch, and aspen stands on burned-over military lands and on several hundred acres of military lands that have been rehabilitated during the last 2 decades. Parks, greenbelts, and residential areas in the Anchorage Bowl also contain browse. Quality riparian habitat abounds along area streams and rivers. Extensive stands of subalpine willow are on south-facing slopes in most drainages in the area. However, during the last 2 decades, overabundant moose have reduced the distribution and density of browse species.

Annual harvests have fluctuated dramatically in recent decades. A record harvest of nearly 500 moose (50% females) occurred in 1965, but hunters harvested only 18 moose in 1978. Diverse harvests were often due to changes in seasons and bag limits as much as changes in the moose population. Annual harvests increased steadily during the late 1980s and early 1990s but began to decline in 1992. The 5-year mean harvest during this reporting period was 87 moose (28% cows).

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVE

Maintain a population of 2000 moose
Maintain a posthunting sex ratio of no fewer than 25 bulls:100 cows.

METHODS

We conducted aerial surveys annually, except in 2000 and 2002, in most hunt areas to estimate sex and age composition during fall and early winter (Table 1). Fall surveys were not flown in 2000 and 2002 because there was inadequate snow cover until late December or early January, after most bulls had shed antlers. Hunters were required to report their success on either harvest or permit reports, depending on whether they participated in the general season or a special

permit hunt. The reports require information on days hunted, hired services, harvest date and location, sex of the animal taken, method of transportation, and antler configuration.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

The moose population was reasonably stable during the 1980s. Stability was partially due to a series of mild winters beginning in 1979–80.

Moose are adversely affected by snow depths of 70–90 cm (28–36 inches), which impede movement, and depths greater than 90 cm restrict movement to the extent that adequate food intake may be unattainable (Coady 1974). Mean snow depths in Anchorage area lowlands are not normally challenging to wintering moose. Since 1988, however, the Anchorage area has experienced a series of severe winters. Continued severe winters will exacerbate overbrowsing, which may result in substantial losses of moose in subsequent years.

Deep snows during the winter of 1994–95 caused a substantial decline in the unit's moose population. Vehicle collisions and starvation caused most of the known moose mortality. The number of moose killed in collisions with vehicles and trains continued to increase (Table 2). Fall 1996 surveys found the moose population 25–30% below the fall 1994 estimate. With milder winters and a reduction in harvest, the unit's moose population recovered by fall 1998 to near or above the management objective of 2000. Another severe winter in 1998–99 reduced the population to an estimated 1650 by fall 1999. The population rebounded to an estimated 1965 in fall 2001. This pattern of population declines following severe winters and slow increases following milder winters is consistent with a population at or above carrying capacity.

Population Size

We estimated a fall 2001 population of 1965 moose in Unit 14C, including the Placer and Portage River drainages (Table 1). The fall 2002 population probably exceeded 2000 moose following the mild winter of 2001–02.

Population Composition

The bull:cow ratio ranged from 36:100 to 53:100. It has increased unitwide, with substantial increases in the Fort Richardson/Elmendorf/Off-base Ship Creek, Peters Creek, and Eklutna/Thunderbird drainages (Table 1). There is no clear trend in bull:cow ratios in other count areas. The calf:cow ratio ranged from 26:100 to 30:100, and the percentage of calves in the population ranged from 16 to 18%. The unit had 9–17 yearling bulls per 100 cows.

Distribution and Movements

Moose are year-round residents, ranging from sea level to an elevation of 3500 feet. During winters with substantial snow accumulation, most moose are at elevations below 1500 feet. Movements of several miles or more by both sexes occur during the breeding season in late September through October and again before green-up in late March and early April.

MORTALITY

Harvest

Season and Bag Limit. The open seasons for resident and nonresident hunters in the Fort Richardson Management Area were 4 September–15 November and 15 December–15 January in 2001–02, and 3 September–15 November and 15 December–15 January in 2002–03. The bag limit was one moose by drawing permit; however, some hunts specified bull or antlerless only. Hunting was limited to archery only, except in the fall season when muzzleloading rifles were permitted north of Eagle River. We issued 95 archery permits and 25 muzzleloader permits for bulls and antlerless moose. We issued an additional 15 drawing permits for both sexes for Elmendorf Air Force Base in 2001 and 2002. The bag limit was one moose; however, bull or antlerless moose were specified on permits, and the season was 4–30 September in 2001 and 3–30 September in 2002. There was no open season in the Anchorage Management Area. The open season in the Birchwood Management Area was 4–30 September in 2001 and 3–30 September in 2002. The bag limit was one moose by drawing permit; however, bull or antlerless moose were specified on permits. Fifteen permits were issued in 2001 and 2002. The open season in the Eklutna Lake Management Area was 4–30 September in 2001 and 3–30 September in 2002. The bag limit was one bull by archery only. The hunt was administered by registration permit with a quota of 4 bulls. The general season in the remainder of Unit 14C was 4–30 September in 2001 and 3–30 September in 2002. The bag limit was 1 bull moose with spike-fork/50-inch antlers; however, hunters could take antlerless moose by drawing permit in specified drainages (40 permits were issued in 2001 and 2002). The open season for the Twentymile River area was 20 August–30 September in 2001 and 2002. The bag limit was 1 bull by drawing permit with 10 permits issued each year.

Board of Game Actions and Emergency Orders. In 1995 and 1996 the Board of Game considered several proposals for a moose hunt in the Anchorage Management Area, but delayed a final decision until the March 1997 meeting in Anchorage. In March 1997 the board considered several proposals for hunting with shotguns and muzzleloaders in Chugach State Park and bow hunts in several municipal parks. None was approved. However, the Board of Game finally authorized a moose hunt for antlerless moose and spike-fork bulls in the upper Campbell, Rabbit and Potter Creek drainages (DM666) in March 1999. No permits have been issued because the Division of Parks and Outdoor Recreation continued to prohibit discharge of firearms in these drainages. Beginning in 1998, only Alaska residents could obtain an antlerless moose permit in the remainder of Unit 14C. In March 1999 the Board of Game extended the season for the Eklutna Management Area to 20 October to allow bowhunting during the rut and extended the general season moose hunt from 20 September to 25 September. The general season moose hunt was extended from 25 September to 30 September beginning in fall 2001. All antlerless moose hunts were reauthorized annually, except DM666 beginning in 2001. The DM666 spike-fork bull bag limit remains in effect.

Following the post-9/11 base closure and in recognition of unprecedented national events, the Board of Game authorized the department to extend the moose hunting season on Elmendorf Air Force Base from 15 December 2001 to 15 January 2002 to allow a winter hunt for 2001 permittees (EO 02-16-01; effective 14 December 2001). Based on positive feedback from hunters and the base's natural resources staff, in March 2003, the Board of Game authorized

extending the hunting season on Elmendorf from 30 September to 15 December and increased the number of permits from 15 to 25 to allow a late-season hunt similar to that on Fort Richardson. Elmendorf natural resources staff preferred a late-season hunt 15 October–15 November. The hunt was initiated in 2003. Because Fort Richardson already had a winter moose hunt, 2001 permittees could not be accommodated in the winter of 2001–02. Instead, the Board of Game extended the permit period to allow permittees who were not successful in taking a moose on Fort Richardson in fall 2001 to be reissued permits to hunt on Fort Richardson in fall 2002 (EO 02-16-01; effective 20 Nov 2001). Some 2001 permittees were unable to participate in 2002, and those permits were issued to new applicants. The total number of Fort Richardson permits was not increased, so only 4 of 20 permits from DM422 and 4 of 40 permits from DM424 were issued to new applicants in 2002.

An emergency order closed the moose-hunting season in the Eklutna Management Area (RM445) effective 3 October 2000, when the quota of 4 moose was achieved. An emergency order closed the moose-hunting season in the Eklutna Management Area effective 21 September 2001, when the quota of 2 moose was achieved. The 2001 quota had been reduced because 5 moose were harvested and 1 mortally wounded during the 2000 season. An emergency order closed the moose-hunting season in the Eklutna Management Area effective 27 September 2002 after the third of the 4-bull quota was reported on 25 September, and it was likely that the quota would be exceeded over the weekend of 28–29 September.

The Board of Game revised 5 AAC 92.230 (Feeding of game). Effective 1 July 2002, it is illegal to negligently leave human food, pet food, or garbage in a manner that attracts moose. The previous wording was “intentionally” rather than “negligently.” Initially the fine was \$50, but it was increased to \$100 in September 2002. In the 2000s a few moose were increasingly reported getting into dumpsters and other garbage containers; however, no citations were issued during this report period for feeding moose.

Hunter Harvest. During the 2001–02 and 2002–03 seasons, 86 and 94 moose were harvested, respectively, with a 2-year mean of 60 bulls and 31 cows (Table 2). Approximately 36% of the bulls were taken during the general season. The remaining moose were taken in permit hunts. Harvests were affected by the emergency closures on Elmendorf Air Force Base and Fort Richardson in fall 2001. The 2 military reservations were closed to public access on 11 September, after the hunting season was open 7 days. Only 3 of 70 hunters were successful, and most had not started to hunt.

Permit Hunts. During the 2001–02 season, we issued 302 permits to hunt moose in Unit 14C. Of these, 54 hunters (32%) were successful. The success rate was much higher than normal, presumably because a higher proportion of permittees than usual did not hunt (44%). Many of these permittees did not hunt due to the loss of public access to the military reservations. Winter moose hunts tend to be more successful than fall hunts in the Anchorage area because permittees are allowed to take either sex, and moose are more numerous and easier to see and track. In 2002–03, 314 permits were issued and 71 hunters (30%) were successful (Table 4).

Drawing permit hunts are very popular. In 2001, 8437 hunters applied for 199 drawing permits (1792 applications were for the 10 bull permits for the Placer/Twenty mile hunts). In 2002, 3846 hunters applied for 140 drawing permits (1091 of the applications were for the 10 permits for the Placer/Twenty mile hunts). The number of applicants has declined in recent years in part because

of the reissuance of many permits in 2002 due to post-9/11 closures and a newly established access fee of \$125 required to hunt on Fort Richardson and Elmendorf AFB. In addition to those receiving drawing permits, 102 bowhunters in 2001 and 114 bowhunters in 2002 registered for a permit for the Eklutna Valley archery hunt. The number of registered bowhunters increased in 1999 due to a hunting extension of one month, which facilitated moose calling during the peak of the rut. However, the number registering to hunt has declined in the last decade, and many of those who register have not hunted, which has increased success rates slightly (Table 4). The high number of unsuccessful bowhunters in this hunt reduces the total success rate for permit hunts (Table 4).

Fort Richardson and Elmendorf AFB proposed to charge a fee for recreational access permits beginning in 2001. The fee was nominal for most recreational activities (\$5 or \$10), including sport angling; however, the user fee was \$125 for moose hunting. I conducted a telephone survey of hunters who had applied for and other hunters who had been issued moose drawing permits on Fort Richardson for the 2000–01 season (Sinnott 2001). All 266 applicants and permittees contacted completed the survey for a response rate of 100%. Fifty-two percent of the permittees were “very satisfied” with their 2000–01 moose hunt. Only 21% were “unsatisfied” or “very unsatisfied.” The “best thing about the hunt” was its convenience, according to 58% of the permittees. Many hunters expressed frustration with the way the hunt was managed by the military. The top 4 complaints (62%) included too few open areas (26%), problems with military police in the field (16%), onerous check-in/checkout procedures (10%), and problems with the orientation class (10%). Nevertheless, most of the applicants (98%) and permittees (93%) intended to apply for a Fort Richardson permit again, and most of the applicants (64%) and permittees (66%) said they would pay a \$100 access fee to hunt on the military reservation. Applicants and permittees gave similar reasons why they would pay a \$100 user fee. The most frequently mentioned reasons were the hunt 1) was close to town and therefore more convenient and less expensive than moose hunts in other parts of the state, 2) has a high success rate, and 3) was generally “worth it.” Many respondents expressed resignation over additional fees; however, they were more likely to accept the fee if it was used for wildlife management and if all user groups paid equitable fees.

Hunter Residency and Success. Residents of Unit 14 accounted for 90% and 87% of the moose harvested in Subunit 14C in 2001–02 and 2002–03, respectively (Table 3). Nonresidents accounted for 4% and 3% of the total harvest in Subunit 14C in 2001–02 and 2002–03, respectively.

Harvest Chronology. It is difficult to compare annual harvests for the first week in September (Table 5) because season opening dates are variable (i.e., the day after Labor Day). After the general season was shortened by 10 days (from 30 September to 20 September) in 1990, harvests shifted primarily to the second week in September, rather than being compressed into the third week, as might be expected (Table 5). The second week in September is essentially the opening week of moose hunting for much of the unit when the day after Labor Day is later than usual (e.g., 8 September in 1998). On the other hand, when the general season was extended from 20 September to 25 September (e.g., 1999 and 2000), about one-fourth to one-third of hunters harvested a bull in the last few days of the season. When the general season hunt was extended from 25 September to 30 September in 2001 and 2002, a relatively large proportion of successful

hunters (9% in 2001 and 13% in 2002) took a bull the last 2 days of the hunting season, and the majority of the harvest shifted from the second to the third week of the hunting season (Table 5). The permit archery hunt is held on military land from mid December through mid January, after many moose summering in the Fort Richardson-Elmendorf-Ship Creek area became accessible in lowland areas of Fort Richardson.

Transport Methods. Approximately two-thirds of all successful moose hunters reached their kill sites by highway vehicle (Table 6). The high proportion of walk-in hunters is due to proximity of many moose to roads and trails and prohibition of motorized off-road vehicles and airplanes in most of Chugach State Park.

Other Mortality

Moose killed by vehicles and trains accounted for 62–73% of known, human-caused mortality during the reporting period. Vehicles killed at least 239 moose and trains killed 22 moose in 1994–95, a record high because of near-record snow depths that forced many moose into town. During this report period, a mean of at least 175 moose were killed in vehicle and train collisions annually (Table 2). These are conservative figures because not all collisions are reported and some moose, never found, die from injuries. An additional 10–20 moose have died from unknown, but not natural, causes each year (e.g., 13 in 2002 and 14 in 2003) and have been salvaged by trappers for use as bait in other units.

Natural mortality was low in the Anchorage area from the mid 1950s to the late 1980s because of moderate annual snowpack and relatively low numbers of predators. More moose have starved in recent winters due to 1) greater than average snowpacks in some years that cover potential browse and require greater expenditure of energy and 2) overbrowsing in previous winters. In recent years, 4–5 packs of wolves have occupied Subunit 14C.

HABITAT

Assessment

Large tracts of subalpine and riparian habitat are protected throughout the 500,000-acre Chugach State Park and Chugach National Forest land between Girdwood and Portage. Several thousand acres of lowland habitat are on military lands between lower Ship Creek and Eagle River. Extensive urbanization has reduced winter range on portions of the military reservation and on private lands throughout the unit. Increased traffic on existing roads continues to boost Anchorage road kills. Several new roads, either in the design stage or proposed (e.g., Abbott Loop extension and Dowling extension), will bisect natural areas and may result in many moose-vehicle collisions. Low-speed roads and trails associated with development, however, also provide movement corridors, which reduce energy expenditures for moose during years of heavy snowfall.

Enhancement

Extensive habitat enhancement on military, state, and municipal lands is not economically feasible because burning, the most cost-effective method, is difficult to do safely in a densely populated area. Habitat enhancement is not a desirable alternative in Chugach State Park. The Chugach National Forest enhanced moose habitat in a limited area near Portage, primarily to enhance viewing opportunity. Winter habitat will inevitably decrease over time in the Anchorage area, as will the number of moose that depend on winter habitat.

CONCLUSIONS AND RECOMMENDATIONS

The population objectives were met. The bull:cow ratio exceeded 25:100. Although the fall 2001 population was estimated at 1965 moose, slightly below the management objective of 2000 moose, the fall 2002 population probably exceeded 2000 moose.

Existing management programs were developed in cooperation with staffs from Fort Richardson, Elmendorf Air Force Base, and Chugach State Park. Through restrictions on harvest methods and compromises on open and closed areas, management regimes have been developed and are acceptable to all parties.

Current regulations adequately address management concerns by providing for substantial hunting opportunities and harvests from a productive moose population in an area where several land management agencies have limited access modes.

Nuisance moose in residential areas remain a significant problem. The Alaska Department of Transportation and Public Facilities (DOT&PF) estimated rural moose-vehicle collisions cost an average of \$15,150 for vehicle repairs; emergency, medical, and legal services; and lost wages (DOT&PF 1995). Moose-vehicle collisions may cost Anchorage residents \$2.4 million/year, based on the number of moose-vehicle collisions reported during this 5-year report period. Moose also cause considerable damage to ornamental plants, vegetable gardens, and fruit trees in winter and spring. Some residents continue to feed local moose, despite the regulation prohibiting feeding, and when a handout is not immediately forthcoming, these moose can be unusually aggressive toward people. Area staff spends considerable time listening and responding to complaints about property damage, public safety, and injured moose. On the other hand, residents tolerate much damage, and most residents and visitors consider moose a desirable species. Public education regarding moose behavior and biology may improve public tolerance and reduce conflicts (Whittaker et al. 2001).

LITERATURE CITED

ALASKA DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES. 1995. A mitigation plan for moose-vehicle accidents on Alaska's rural highways. Anchorage.

COADY, J. W. 1974. Influence of snow on behavior of moose. *Nature Canada*. 101:417–436.

SINNOTT, R. 2001. Moose drawing permits on Fort Richardson, Alaska: a telephone survey of applicants and hunters. Unpublished report. Division of Wildlife Conservation, Alaska Department of Fish and Game, Anchorage, Alaska. 18 pp.

WHITTAKER, D., M. J. MANFREDO, P. J. FIX, R. J. SINNOTT, S. MILLER, AND J. J. VASKE. 2001. Understanding beliefs and attitudes about an urban wildlife hunt near Anchorage, Alaska. *Wildlife Society Bulletin* 29:1114–1124.

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Table 1 Subunit 14C fall aerial moose composition counts and estimated population size, 1998–2003

Area	Regulatory year	Bulls: 100 cows	Yearling bulls: 100 cows	Calves: 100 cows	Calves (%)	Total moose observed	Moose /hour	Estimated population size ^a
Twentymile River	1998–99	24	4	30	19	181	48	240
Portage River	1999–2000	18	4	23	16	116	35	135
Placer River	2000–01 ^b	--	--	--	--	--	--	
	2001–02	--	--	--	--	--	--	180
	2002–03 ^b	--	--	--	--	--	--	
Hillside	1998–99	29	13	36	22	213	70	280
	1999–2000	35	7	35	21	145	51	170
	2000–01 ^b	--	--	--	--	--	--	
	2001–02	46	26	33	19	161	49	185
	2002–03 ^b	--	--	--	--	--	--	
Anchorage Bowl (except Hillside)	1998–99	--	--	--	--	--	--	300 ^c
	1999–2000	--	--	--	--	--	--	250 ^c
	2000–01 ^b	--	--	--	--	--	--	
	2001–02	--	--	--	--	--	--	300 ^c
	2002–03 ^b	--	--	--	--	--	--	
Fort Richardson	1998–99	42	13	32	18	386	32	503
Elmendorf AFB	1999–2000	57	24	31	16	408	31	474
Off-base Ship Cr.	2000–01 ^b	--	--	--	--	--	--	
	2001–02	63	20	33	17	482	29	555
	2002–03 ^b	--	--	--	--	--	--	

Table 1 Continued

Area	Regulatory year	Bulls: 100 cows	Yearling bulls: 100 cows	Calves: 100 cows	Calves (%)	Total moose observed	Moose /hour	Estimated population size ^a
Eagle River	1998–99	36	6	22	14	101	--	130
	1999–2000	--	--	--	--	--	--	110
	2000–01 ^b	--	--	--	--	--	--	
	2001–02	--	--	--	--	--	--	120
	2002–03 ^b	--	--	--	--	--	--	
Peters Creek	1998–99	73	16	16	9	69	24	90
	1999–2000	95	11	26	12	42	19	50
	2000–01 ^b	--	--	--	--	--	--	
	2001–02	112	23	31	13	63	20	70
	2002–03 ^b	--	--	--	--	--	--	
Eklutna River Thunderbird Cr.	1998–99	18	0	24	17	48	13	60
	1999–2000	28	6	22	15	48	12	55
	2000–01 ^b	--	--	--	--	--	--	
	2001–02	42	8	11	7	55	12	65
	2002–03 ^b	--	--	--	--	--	--	
Bird Creek Indian River ^d	1998–99	--	--	--	--	--	--	150
	1999–2000	--	--	--	--	--	--	120
	2000–01 ^b	--	--	--	--	--	--	
	2001–02	--	--	--	--	--	--	140
	2002–03 ^b	--	--	--	--	--	--	

Table 1 Continued

Area	Regulatory Year	Bulls: 100 cows	Yearling bulls: 100 cows	Calves: 100 cows	Calves (%)	Total moose observed	Moose /hour	Estimated population size ^a
Hunter Creek	1998–99	36	0	27	16	104	52	140
Knik River	1999–2000	23	4	12	9	123	37	145
	2000–01 ^b	--	--	--	--	--	--	
	2001–02	23	4	21	15	163	44	185
	2002–03 ^b	--	--	--	--	--	--	
Lake George ^e	1998–99	--	--	--	--	--	--	165
	1999–2000	--	--	--	--	--	--	140
	2000–01 ^b	--	--	--	--	--	--	
	2001–02	--	--	--	--	--	--	165
	2002–03 ^b	--	--	--	--	--	--	
Unit 14C	1998–99	36	9	30	18	1102	35	2100
Total	1999–2000	41	13	26	16	882	31	1650
	2000–01 ^b	--	--	--	--	--	--	
	2001–02	53	17	29	16	924	29	1965
	2002–03 ^b	--	--	--	--	--	--	

^a Estimates based on sightability indices of 0.77 (1998), 0.86 (1999) and 0.87 (2001), calculated with MOOSPOP for the Fort Richardson survey. Estimates in unsurveyed drainages are extrapolated based on trends in adjacent count areas.

^b Fall surveys not conducted due to lack of snow.

^c No aerial surveys; estimate is best guess.

^d Last surveyed in 1988.

^e Last surveyed in 1997.

Table 2 Subunit 14C moose harvest and accidental death, 1998–2003

Regulatory year	Hunter harvest						Accidental death ^b			
	Reported			Estimated						
	M (%)	F (%)	Total ^a	Unreported	Illegal	Total	Road	Train	Total	Total
1998–99	72 (74)	25 (26)	97	10	10	20	152	6	158	275
1999–2000	61 (84)	12 (16)	73	10	10	20	150	11	161	254
2000–01	63 (72)	24 (28)	87	10	10	20	160	5	165	272
2001–02	57 (66)	29 (34)	86	10	10	20	229	9	238	344
2002–03	62 (66)	32 (34)	94	10	10	20	143	11	154	268

^a Includes those with unreported sex.

^b Reported deaths only.

Table 3 Subunit 14C moose hunter residency and success, 1998–2003

Regulatory year	Successful				Unsuccessful				Total hunters
	Local resident ^a	Nonlocal resident	Nonresident	Total (%) ^b	Local resident ^a	Nonlocal resident	Nonresident	Total (%) ^b	
1998–99	94	1	2	97 (19)	418	7	3	428 (81)	525
1999–2000	64	5	4	73 (14)	437	19	4	461 (86)	534
2000–01	80	5	2	87 (20)	320	17	6	347 (80)	434
2001–02	77	6	3	86 (27)	217	10	5	232 (73)	318
2002–03	82	9	3	94 (21)	316	20	9	345 (79)	439

^a Residents of Unit 14 (majority from Subunit 14C).

^b Includes hunters with unspecified residency.

Table 4 Subunit 14C moose harvest data by permit hunt, 1998–2003

Hunt no. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Total harvest ^a
DM210, 211	1998–99	50	16	57	43	100	0	18
Twentymile	1999–2000	35	54	100	0	0	0	0
Portage	2000–01	10	40	83	17	100	0	1
Placer	2001–02	10	30	43	57	100	0	4
	2002–03	10	40	67	33	100	0	2
DM424,425,427	1998–99	95	14	61	39	75	25	32
Fort Richardson	1999–2000	95	14	65	35	72	28	29
(archery only)	2000–01	95	16	50	50	73	27	40
	2001–02	95	38	47	53	39	61	31
	2002–03	95	14	61	39	41	59	32
DM422,423	1998–99	25	20	72	28	67	33	6
Fort Richardson	1999–2000	25	8	61	39	89	11	9
(muzzleloader)	2000–01	25	16	67	33	57	43	7
	2001–02	25	76	67	33	100	0	2
	2002–03	25	8	57	43	80	20	10
RM445 ^b	1998–99	161	35	97	3	100	0	3
Eklutna	1999–2000	311	22 ^c	98	2	100	0	3
(archery only)	2000–01	229	54 ^d	95	5	100	0	5
	2001–02	102	59 ^e	93	7	100	0	3
	2002–03	114	43 ^f	94	6	100	0	4

Table 4 Continued

Hunt no. /Area	Regulatory Year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Total harvest ^a
DM441 Hunter Knik	1998–99	20	15	59	41	17	83	7
	1999–2000	20	5	95	5	0	100	1
	2000–01	10	0	70	30	0	100	3
	2001–02	10	20	75	25	0	100	2
	2002–03	10	10	67	33	0	100	3
DM428, 429 Elmendorf AFB (archery only)	1998–99	15	7	43	57	50	50	8
	1999–2000	15	7	50	50	86	14	7
	2000–01	15	7	50	50	57	43	7
	2001–02	15	7	43	57	50	50	8
	2002–03	15	13	31	69	56	44	9
DM442 Ship	1998–99	10	50	80	20	0	100	1
	1999–2000	20	30	93	7	0	100	1
	2000–01	20	20	81	19	0	100	3
	2001–02	20	35	92	8	0	100	1
	2002–03	20	15	65	35	0	100	6
DM443 Peters and Little Peters	1998–99	10	10	78	22	0	100	2
	1999–2000	10	20	100	0	0	0	0
	2000–01	10	30	86	14	0	100	1
	2001–02	10	10	89	11	0	100	1
	2002–03	10	20	62	38	0	100	3

Table 4 Continued

Hunt no. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Total harvest ^a
DM448, 449 Birchwood ^c (archery only)	1998–99	15	7	79	21	33	67	3
	1999–2000	15	20	92	8	100	0	1
	2000–01	15	27	73	27	100	0	3
	2001–02	15	27	91	9	0	100	1
	2002–03	15	27	82	18	50	50	2
Totals for all permit hunts	1998–99	401	23	74	26	69	31	80
	1999–2000	546	31	86	14	77	23	51
	2000–01	429	35	74	26	66	37	70
	2001–02	302	44	68	32	46	54	54
	2002–03	314	25	70	30	55	45	71

^a Includes moose with unspecified sex.

^b Registration hunt.

^c Includes 58 permittees who did not report.

^d Includes 39 permittees who did not report.

^e Includes 21 permittees who did not report.

^f Includes 22 permittees who did not report.

Table 5 Subunit 14C moose harvest^a chronology, 1998–2003

Regulatory year	Percent of harvest					n
	9/1–9/7	9/8–9/14	9/15–9/21	9/22–9/28	9/29–10/5	
1998–99 ^b	--	56	44	--	--	16
1999–2000 ^c	5	32	27	36	--	22
2000–01 ^d	20	33	20	27	--	15
2001–02 ^e	6	19	34	31	9	32
2002–03 ^f	4	17	43	22	13	23

^a Excludes permit hunt harvests.^b Season 9/8–9/20^c Season 9/7–9/25^d Season 9/5–9/25^e Season 9/4–9/30^f Season 9/3–9/30

Table 6 Unit 14C moose harvest percent by transport method, 1998–2003

Regulatory year	Percent of harvest								n
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Off-road vehicle	Highway vehicle	Unknown/ Other	
1998–99	2	5	10	2	0	6	71	3	87
1999–2000	4	4	1	1	0	1	86	3	73
2000–01	2	1	6	0	0	2	84	5	87
2001–02	5	6	4	3	0	1	60	7	86
2002–03	6	7	4	0	0	0	68	9	94

MOOSE MANAGEMENT REPORT

From: 1 July 2001

To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 15A (1314 mi²)

GEOGRAPHIC DESCRIPTION: Northern Kenai Peninsula

BACKGROUND

Historical records and reports from residents indicate moose were abundant throughout the 1900s in Subunit 15A. The most recent population peak occurred in 1971. The near absence of wolves from 1913 to 1968 and increased moose survival following a 500-square-mile forest fire in 1947 were 2 factors that increased moose numbers throughout the 1950s and 1960s. Although seasons were long and either-sex harvest was allowed, the moose population increased beyond its carrying capacity and extensive overbrowsing occurred by the late 1960s. A wildfire in 1969 burned approximately 135 mi² (11 percent of 15A), initially reducing moose habitat in 15A, then harsh winters from 1971 to 1974 reduced the moose population over the entire Kenai Peninsula. Estimates for Subunits 15A and 15B indicate the combined population estimate declined from 7900 in 1971 to 3375 by 1975. Subunit 15A represents 75% of these estimates, a decline from 5900 to 2500 moose. By 1982, following more favorable winters, the moose population estimate for 15A increased to 3000.

In 1987 and 1990 estimation methods described by Gasaway (1986) were used in the unit for the first time. They indicated a stable population trend in the range of 3014–3850 moose. In February 2001, we completed a moose census using methods developed by Jay VerHoef (ADF&G Fairbanks biometrician). Using VerHoef's modified Gasaway census technique we estimated the moose population in Subunit 15A at 2097 (95% confidence intervals 1704–2431). The winters of 1998–99 and 1999–2000 were classified as severe for 15A with snow accumulation up to 40 inches.

No large wildfires have occurred since 1969 on the Kenai Peninsula. Consequently, less browse associated with successional forest stages was available to moose and a gradual decline in moose population size is anticipated during normal winters. Small wildfires and intentional habitat improvement efforts have temporarily reversed this general trend in local areas.

Increased human presence and impact of the Alaska National Interest Lands Conservation Act on the Kenai Peninsula have increased the necessity for cooperative interagency management of renewable resources. To this end, the department works closely with a variety of agencies and landholders while retaining management authority for wildlife on nonfederal lands and nonsubsistence wildlife species on federal lands. The Kenai National Wildlife Refuge is the

largest landholder in Subunit 15A and actively participates in a variety of cooperative moose management programs. These include support of the ADF&G Moose Research Center near Sterling, cooperative management of Skilak Loop as a wildlife viewing area, and recent attempts to provide increased access for hunters in wheelchairs. Close coordination and cooperation should continue.

A selective harvest strategy with a spike/fork-50-inch bag limit was initiated on the Kenai Peninsula in 1987. The proportion of males in the population has subsequently increased, and hunters seem generally satisfied with the selective harvest strategy. We completed a 5-year evaluation of selective harvest on the Kenai in 1992, and a 10-year evaluation in 1999.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

Maintain a healthy population of moose with a posthunting bull-to-cow ratio of at least 15:100 in Unit 15A, excepting the Skilak Loop Wildlife Management Area (SLWMA).

Primary moose management objectives in the SLWMA are to:

- View moose in a natural setting throughout the year.
- Provide opportunities to view all components of the moose community, including their behavior and habitat.
- Provide opportunities to harvest moose when a reduction in numbers is desirable to achieve other objectives.
- Achieve and maintain the resident population at 130 animals or a density of 1.8 to 2.0 moose per mi². Resident moose in excess of 130 will be available for harvest.
- Increase the bull-to-cow ratio to at least 40 bulls:100 cows.

In addition to the resident population, moose from surrounding areas commonly winter in SLWMA. Winter populations reach 300 animals. Habitat will be managed to provide for 130 resident and up to 170 additional wintering moose.

METHODS

During years with adequate snowfall, we conducted aerial surveys in November and December in selected trend count areas to ascertain sex and age composition. In 2001 and 2002 weather conditions were not suitable to conduct these surveys.

A population estimate for Subunit 15A was developed from data collected in February 2001. Ver Hoef developed the techniques used for S-Plus Spatial Statistics.

All of the harvest data is now kept at the ADF&G's Web-based database called WinfoNet. This report reflects updated data in all tables; therefore, data may differ slightly from past reports.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The February 2001 estimate for moose wintering in the unit was $2097 \pm 15.9\%$ (1704–2431) at the 95% CI. The February 1990 estimate for moose wintering in the unit was $3432 \pm 12.18\%$ (3014–3850) at the 90% CI. These data indicate a decline of approximately 39 percent of the mean; however, it is believed that most of this decline occurred during the severe winters of 1998–99 and 1999–2000. The winters of 2000–01 through 2002–03 were relatively mild and should have been favorable for moose survival and production.

Population Composition

Poor weather and lack of complete snow cover prevented us from completing a fall sex and age composition survey in 1999–2000, 2000–01 or 2002–03. In 1998 we observed 1528 moose in fall composition surveys, compared to 1467 in 1996 (Table 1). Calves composed 17% of the 1998 sample and occurred in the proportion of 27:100 cows. Calf composition data declined compared to data from 1992 to 1996; however, calf survival was high the previous year.

MORTALITY

Harvest

Season and Bag Limit. The general open season in Subunit 15A was 20 August–20 September. In spring of 1995 the Alaska Board of Game approved an archery season for 10–17 August. Archery hunters were restricted to the same bag limit used during the general season. The bag limit was 1 bull with spike/fork or 50-inch antlers or at least 3 brow tines on at least 1 antler (SF/50). Forty permits were issued in a drawing permit hunt in the SLWMA for antlerless moose in 1999–2000 and 20 permits for spike/fork bulls. The antlerless season was 15–30 September and the spike/fork bull season 21–30 September. The bag limit for the antlerless season prohibited harvesting of calves and females with calves. These permit hunts were not held during the fall 2000–2003 seasons.

During the last 5 years the annual moose harvest ranged from 91–271 (Table 2), while the number of hunters ranged from 1161–1428 (Table 4). Variations in harvest generally reflect the number of yearling bulls available (which is related to winter severity) and weather conditions during the hunting season. Results of a 10–17 August archery season are included in the total harvest figures.

Federal subsistence harvest statistics were not available for the past 2 years when this report was written. However, no moose harvests were reported during the 18–19 August federal subsistence season during the previous 4 years.

Board of Game Actions and Emergency Orders. No Board of Game action was taken during this reporting period.

Permit Hunts. No permits were issued for the SLWMA during this report period. Due to a lack of adequate snow cover, we were not able to conduct surveys in this area. By agreement with the

Kenai National Wildlife Refuge, a survey of the area must be completed, and a minimum count of 130 moose must be obtained before permits for this can be issued.

Hunter Residency and Success. During the last 5 years hunter success ranged from 8 to 19% (Table 4). During all years, local residents (people living in Unit 15) accounted for the vast majority (79–86%) of moose hunters using this subunit.

Transport Methods. Most moose hunters use highway vehicles as their primary method of transportation to access hunting areas in Subunit 15A. The percentage of hunters using highway vehicles ranged from 55 to 74% during the last 5 years (Table 5).

Harvest Chronology. Twenty-one percent of the 2001 and 24% of the 2002 harvest occurred during the 10–17 August archery season (Table 6). Twenty-one percent of the 2001 and 23% of the 2002 harvest occurred during the first 5 days of the general hunt season. The highest percentage of harvest occurred during these 2 time periods during this report period.

Other Mortality

Crippling loss by hunters and loss to predation was unknown. In 2001, 100 moose were reported killed in 15A by vehicle/wildlife accidents, compared to 73 in 2002 (Table 2). About 50% of moose killed by vehicles each year are calves. Between 1998 and 2002, on average 90 moose were killed in wildlife/vehicle accidents in Unit 15A. A public awareness program begun in 1990 to reduce the number of vehicle/wildlife collisions (Del Frate and Spraker 1991) has failed to demonstrate a significant reduction in accidents.

HABITAT

Assessment

The 1969 burn (85,000 acres) is still providing browse for most of the moose wintering in Subunit 15A. However, this area and small areas of improved habitat north of Skilak Lake compose only 10–15% of moose habitat in the unit. The remaining moose habitat is unproductive due to forest succession and browse heights not optimal for moose.

Enhancement

In May 1991 approximately 8320 acres burned in the southeastern portion of 15A near Pothole Lake. This burn is expected to increase available moose habitat; however, this may only benefit animals in the immediate area of the burn due to its small size. Substantial statewide publicity regarding beneficial effects of wildfire for forest succession wildlife stemmed from the Pothole Lake fire.

A 10,369-acre area in the Mystery Creek Road vicinity was to be burned by U.S. Fish and Wildlife Service in the fall of 1991. Unfavorable weather conditions and other factors prevented this prescribed burn project until July 1999 when a small portion of the area was burned. Approximately 40% of this area was to be left untreated as scattered islands for wildlife cover and as a seed source for revegetation.

CONCLUSIONS AND RECOMMENDATIONS

Kris Hundertmark (ADFG) completed a 10-year review of the selective harvest strategy in 1999. The bull-to cow-ratio increased from a 5-year (1982–86) average of 13:100 to 22:100 in 1991, but declined to 16:100 in 1992 following the severe winter of 1991–92. In 1994–95 the ratio rebounded to 24:100 and remained relatively stable at 26:100 in the 1996 and 1997 fall composition surveys. In 1998 the ratio increased to 31:100.

With the increase in the number of bulls, the opportunity for viewing and photography has increased. Public perception of improved population health and the need for public support for continuation of the SF/50 program has also widened.

Composition surveys were conducted during November 2003. We counted a total of 510 cows, 118 bulls, and 132 calves (23 bulls:100 cows and 26 calves:100 cows). A more complete analysis of these data will be provided in the next management report because these counts occurred after this report period. Over the past 5 years, hunter effort has averaged 1242 hunters per season, ranging from 1161 to 1428. The interest in archery hunting has also remained high, with the archers taking 21% and 24% of the harvest in the past 2 years, respectively.

During the past 10 years, 5 severe winters have affected moose numbers in Subunit 15A. The number of available bulls following these winters declined, as did the harvest.

Unlike other game management units in Alaska, no emergency reduction in the 2001–02 or 2002–03 moose seasons or bag limit was necessary due to effects of the previous winters. The conservative nature of the SF/50 bag limit on the Kenai Peninsula allowed the department to continue to offer the same recreational opportunity as in previous years. No changes in management objectives or bag limits are recommended at this time. Currently, the largest impacts on the Kenai Peninsula moose population are declining habitat quality and deaths caused by collisions with motor vehicles.

LITERATURE CITED

DEL FRATE, G.G. AND T.H. SPRAKER. 1991. Moose vehicle interactions and an associated public awareness program on the Kenai Peninsula, Alaska. *Alces* 27:1–10.

GASAWAY, W.C., S.D. DUBOIS, D.J. REED, AND S.J. HARBO. 1986. Estimating moose population parameters from aerial surveys. *Biological Papers of the University of Alaska* No. 22. University of Alaska Fairbanks. 108pp.

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Table 1 Unit 15A aerial moose composition counts and estimated population size, 1998–2003

Regulatory year	Bulls: 100 Cows	Yearling bulls: 100 Cows	Calves: 100 Cows	Calves (%)	Adults	Total moose observed	Estimated population size
1998–1999 ^a	29	9	27	17	1248	1508	3000–3800
1999–2000		No Surveys					
2000–2001 ^b				20	1617		1704–2431
2001–2002 ^a	21	6	31	20	620	778	1500–2500
2002–2003		No Surveys					1500–2500

^a Summary of composition counts^b Estimates from geostatistical census method, estimated population size shown = 95% CI

Table 2 Unit 15A general season moose harvest and accidental death, 1998–2003

Regulatory year	Hunter Harvest							Accidental death			Grand total
	Reported				Estimated						
	M	F	Unk	Total	Unreported	Illegal	Total	Road	Train	Total	
1998–1999	267	0	4	271			40	138	0	138	449
1999–2000	87	0	4	91			40	81	0	81	212
2000–2001	130	0	1	131			40	59	0	59	230
2001–2002	227	0	1	228			40	100	0	100	368
2002–2003	139	1	1	141			40	73	0	73	254

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 3 Unit 15A harvest data for drawing permit hunts, 1998–2003

Hunt No. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Unk.	Total harvest
DM524	1998–1999	40	10	69	31	0	11	0	11
Skilak	1999–2000	40	15	71	29	0	8	0	8
Loop	2000–2001	No	Season						
Antlerless	2001–2002	No	Season						
	2002–2003	No	Season						
Skilak	1998–1999	No	Season						
Loop	1999–2000	20	16	100	0	0	0	0	0
Spike/ Fork	2000–2001	No	Season						
	2001–2002	No	Season						
	2002–2003	No	Season						

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 4 Unit 15A moose hunter residency and success for the general season, 1998–2003

Regulatory year	Successful				Unsuccessful				Total hunters
	Local ^a resident	Nonlocal resident	Nonresident	Total (%)	Local ^a resident	Nonlocal resident	Nonresident	Total	
1998–1999	238	30	3	271(19)	997	143	17	1157	1428
1999–2000	78	9	4	91 (8)	935	150	18	1103	1194
2000–2001	103	23	5	131(11)	814	199	19	1032	1163
2001–2002	196	28	4	228(18)	848	163	25	1036	1264
2002–2003	119	19	3	141(12)	835	156	29	1020	1161

^a Local = residents of Unit 15

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 5 Unit 15A moose general season transport methods (% of harvest), 1998–2003

Regulatory year	Percent of harvest							Unknown	<i>n</i>
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle		
1998–1999	3	0	7	9	0	3	72	6	271
1999–2000	8	1	16	12	0	5	55	2	91
2000–2001	4	2	11	12	0	3	66	2	131
2001–2002	3	1	7	11	0	3	72	3	228
2002–2003	4	1	6	9	0	1	74	5	141

All data has been updated from the ADF&G online database: WildlifeInfoNet.

Table 6 Unit 15A moose general season harvest chronology (% of harvest), 1998–2003

Regulatory year	Harvest periods ^a							Unk	<i>n</i>
	8/10–8/17	8/20–25	8/26–8/31	9/1–9/5	9/6–9/10	9/11–9/15	9/16–9/20		
1998–1999	17	23	8	8	8	15	14	6	271
1999–2000	16	16	5	10	11	15	20	5	91
2000–2001	11	24	7	8	8	13	28	2	131
2001–2002	21	21	8	4	10	17	16	4	228
2002–2003	24	23	9	4	4	14	18	4	141

^a Archery season 10–17 Aug, general open season 20 Aug–20 Sep

All data has been updated from the ADF&G online database: WildlifeInfoNet.

MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 15B (1121 mi²)

GEOGRAPHIC DESCRIPTION: Kenai Peninsula

BACKGROUND

The moose population in Subunit 15B has been relatively stable for the past decade. Censuses conducted in 1990 and 2001 estimated the population at around 1000. Forests within 15B have succumbed to widespread spruce bark beetle (*Dendroctonus rufipennis*) infestations that began in the 1990s. More than 500,000 hectares of spruce forests have been affected (www.borough.kenai.ak.us/sprucebeetle). Since 2001, infestation rates are decreasing as the number of unaffected trees becomes scarce (U.S.D.A. et al. 2002). Salvage logging efforts are limited because most of the area in 15B is within the Kenai National Wildlife Refuge and has a "wilderness" designation, which limits all commercial activities.

About 10% of the Kenai Peninsula's moose harvest over the past 20 years has come from 15B. Most of the hunting within 15B is by drawing permit only (15B East) and is designated as a "trophy" area.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

Central Kenai Peninsula

- Maintain a population of moose with a bull-to-cow ratio of 15:100
- Allow for maximum opportunity to participate in hunting in 15B West

In 15B East

- Maintain a population of moose with a bull-to-cow ratio of 40:100
- Provide for the opportunity to harvest a large-antlered bull under aesthetically pleasing conditions

METHODS

Composition surveys are flown in traditional count areas as funding allows. Harvest data is provided by hunter information taken from harvest tickets. All the harvest data is now kept at

ADF&G's Web-based database called WinfoNet. This report reflects updated data in all tables using data from WinfoNet; therefore, data may differ slightly from past reports.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

A February 2001 census of the 650.4 square miles of suitable moose habitat in Subunit 15B estimated the population at 958 moose (95% CI: 777–1139). This produced a density of about 1.5 moose/mi². Because the census was conducted during February after most bulls had shed their antlers, composition by sex was not determined. Calves composed 21% of the population, compared to 10% found in the February 1990 census (Table 1). No survey flights have been conducted since this 2001 census.

MORTALITY

Harvest

<u>Season and Bag Limit.</u>	<u>Resident Open Season</u>	<u>Nonresident Open Season</u>
<i>Unit 15B</i> that portion bounded by a line running from the mouth of Shantatalik Creek on Tustumena Lake, northward to the west fork of Funny River to the Kenai National Wildlife Refuge; then east along the refuge boundary to its junction with the Kenai River and Skilak Lake; then south along the western side of Skilak River, Skilak Glacier and Harding Icefield; then west along the Unit 15B boundary to the mouth of Shantatalik Creek. One bull with 50-inch antlers by drawing permit only; up to 100 permits will be issued.	1 Sep–20 Sep 26 Sep–15 Oct	1 Sep–Sep 20 26 Sep–15 Oct
<i>Remainder of Unit 15B</i> One bull with spike-fork or 50-inch antlers or antlers with 3 brow tines on at least 1 side, by bow and arrow only or 1 bull with spike-fork or 50-inch antlers or 3 brow tines or more on at least 1 side		10 Aug–17 Aug 20 Aug–20 Sep

The 5-year average reported harvest for the general season in 15B was 48 moose (Table 2).

Board of Game Actions and Emergency Orders. There were no board actions for 15B moose during the reporting period

Permit Hunts. Subunit 15B East is managed as an area where hunters are able to view and harvest large-antlered bulls through a drawing permit system. A total of 2039 and 1839 applications were received during 2001 and 2002, respectively for all drawing hunts in 15B. Permittees reported harvesting 16 bulls in 2001 and 12 in 2002 (Table 3).

Hunter Residency and Success. Most 15B hunters during the general season were residents of Unit 15 (Table 4). The success rate averaged 16% over the past 5 seasons (Table 4).

Transport Methods. Highway vehicles encompass the majority of transportation methods used by successful hunters in 15B during the general season (Table 5).

Harvest Chronology. Moose were harvested throughout the season (Table 6). The chronology of the harvest is dependent on weather conditions and other factors unrelated to moose abundance.

Other Mortality

An average of 45 moose per year have been killed by motor vehicles in Unit 15B during the past 5 years (Table 2). The impact of predation on moose by wolves and bears is unknown. The level of mortality for moose during severe winters is likely high.

HABITAT

Assessment and Enhancement

No significant burns have occurred since 1890 when a wildfire burned most of the unit. The U.S. Fish and Wildlife Service enhanced approximately 3700 acres of predominantly winter habitat using a variety of mechanical tree removal techniques in 1968. Since 1968, five wildfires and one controlled burn have occurred, resulting in 11,500 acres burned, or 3% of the acreage below timberline. The advancement of blue-joint grass (*Calamagrostis canadensis*) after beetle infestations typically reduces the regeneration of hardwoods and spruce saplings. This process could slow forest succession and may negatively impact moose browse in the area.

CONCLUSIONS AND RECOMMENDATIONS

The permit hunts in 15B East continue to provide excellent opportunities to hunt and view large bulls and continue to be popular among residents. The only practical means of access into this area is by horse, and the cost of contracting with a local outfitter has increased beyond what most hunters are willing to pay.

Harvest levels are well within acceptable guidelines to maintain a minimum bull:cow ratio of 40:100. Summer and winter moose range on the Kenai National Wildlife Refuge in 15B continues to deteriorate due to wilderness lands management policies that favor advanced forest succession. ADF&G and the U.S. Fish and Wildlife Service should cooperate on selected habitat enhancement projects (mechanical manipulation and prescribed burns) to improve moose habitat in the unit.

LITERATURE CITED

U.S. DEPARTMENT OF AGRICULTURE, U.S. FOREST SERVICE, AND DEPARTMENT OF NATURAL RESOURCES-DIVISION OF FORESTRY. February 2002. Forest Insect and Disease Conditions in Alaska-2002, General Technical Report R10-TP-113.

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Table 1 Unit 15B aerial moose composition counts and estimated population size, 1998–2003

Regulatory year	Bulls: 100 Cows	Yearling bulls: 100 Cows	Calves: 100 Cows	Calves (%)	Adults	Moose observed	Estimated population size
1998–1999		No Surveys					
1999–2000		No Surveys					
2000–2001 ^a				21	766		777–1139
2001–2002		No Surveys					
2002–2003		No Surveys					

^a Estimates from geostatistical census method, estimated population size shown = 95% CI

Table 2 Unit 15B general season moose harvest and accidental death, 1998–2003

Regulatory year	Hunter Harvest							Accidental death			Total
	Reported				Estimated			Road	Other	Total	
	M	F	Unk	Total	Unreported	Illegal	Total				
1998–1999	56	0	1	57			20	74	--	74	131
1999–2000	42	0	1	43			20	47	--	47	110
2000–2001	47	0	0	47			20	30	--	30	97
2001–2002	49	0	1	50			20	42	--	42	112
2002–2003	40	1	0	41			20	33	--	33	94

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 3 Unit 15B East harvest data for drawing permit hunts, 1998–03

Hunt Nr/ Area	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Unk.	Total harvest
Totals for	1998–1999	100	37	70	30	19(100)	0	0	19
all permit	1999–2000	100	35	74	26	17(100)	0	0	17
hunts	2000–2001	100	38	73	27	17(100)	0	0	17
DM530–539	2001–2002	100	35	75	25	16(100)	0	0	16
	2002–2003	100	40	80	20	12(100)	0	0	12

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 4 Unit 15B West moose hunter residency and success for the general season, 1998–03

Regulatory year	Successful				Unsuccessful				Total hunters
	Local ^a resident	Nonlocal resident	Nonresident	Total ^b (%)	Local ^a resident	Nonlocal resident	Nonresident	Total ^b	
1998–1999	55	2	0	57 (17)	236	35	2	273	330
1999–2000	42	1	0	43 (15)	197	32	6	235	278
2000–2001	41	4	1	47 (17)	198	28	2	229	276
2001–2002	49	1	0	50 (17)	223	26	3	252	302
2002–2003	38	1	2	41 (14)	221	19	5	245	286

^a Local = residents of Unit 15

^b Includes unspecified residency

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 5 Unit 15B West moose general season transport methods (% of harvest), 1998–03

Regulatory year	Percent of harvest							Unknown	<i>n</i>
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle		
1998–1999	0	5	5	9	0	5	65	11	57
1999–2000	0	9	5	7	0	7	67	5	43
2000–2001	2	6	9	4	0	0	74	4	47
2001–2002	0	4	2	18	0	2	66	8	50
2002–2003	0	15	0	7	0	2	66	10	41

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 6 Unit 15B moose general season harvest chronology (% of harvest), 1998–03

Regulatory Year	Harvest periods ^a							Unknown	<i>n</i>
	8/10–17	8/20–25	8/26–8/31	9/1–9/5	9/6–9/10	9/11–9/15	9/16–9/20		
1998–1999		42	9	4	11	12	16	7	57
1999–2000	26	28	7	0	2	16	16	5	43
2000–2001	17	15	4	0	13	19	28	4	47
2001–2002	16	20	8	0	10	8	24	14	50
2002–2003	24	15	10	15	7	7	12	10	41

^a Archery season 10–17 Aug (established in 1999), general open season 20 Aug–20 Sep

All data has been updated from the ADF&G online database: WildlifeInfoNet

MOOSE MANAGEMENT REPORT

From: 1 July 2001

To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 15C (2441 mi²)

GEOGRAPHIC DESCRIPTION: Southern Kenai Peninsula

BACKGROUND

The moose population in Subunit 15C has contributed on average more than 40% of the Kenai Peninsula's moose harvest during the past 20 years. Available habitat on the lower peninsula can be limiting in winters with heavy snow accumulations. Important winter habitat includes the Ninilchik River, Stariski Creek, Anchor River, Fritz Creek, lower reaches of Fox River and Sheep Creek, and the Homer Bench. Despite several winters of deep snow in the late 1990s, the estimated moose population size increased about 30% between surveys in 1993 and 2002. Community development continues to grow, increasing the interactions of human residents and moose.

Widespread spruce bark beetle (*Dendroctonus rufipennis*) infestations commencing in the 1990s have impacted more than 500,000 hectares of spruce forests on the Kenai Peninsula (www.borough.kenai.ak.us/sprucebeetle). Since 2001, infestation rates are decreasing as the number of unaffected trees becomes scarce (U.S.D.A. et al. 2002). Much of the affected forests has been, or is, scheduled for salvage logging. Spruce mortality and salvage logging efforts will affect the quality of moose habitat on a large scale, but the nature of the effect remains uncertain.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

- Maintain a healthy and productive population
- Maintain a minimum sex ratio range of 15-20 bulls:100 cows

METHODS

Composition surveys are flown in traditional count areas as funding allows. Censuses were done in 1993 and 2002. Harvest data come from hunter information taken from harvest tickets. All harvest data is now kept at the Department's Web-based database called WinfoNet. This report reflects updated data in all tables using data from WinfoNet; therefore data may differ slightly from past reports.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

A random-stratified census (Gasaway 1986) was conducted in lowland portions of Subunit 15C (1190 mi²) during the winter of 1992–93. The population was estimated at 2079 moose (95% CI: 1425–2734). During the winter of 2001–02, a geostatistical census (Ver Hoef 2001) conducted over the same area produced an estimate of 2981 moose (95% CI: 2508–3454). A comparison between surveys showed a population increase of about 30% (Table 1). Both censuses were conducted in late winter, precluding composition counts. There were likely additional moose in the mountainous portion of Subunit 15C, outside the census area, during both censuses.

Population Composition

The actual number of moose seen during composition counts is not comparable from year to year because survey intensity and conditions are inconsistent. Composition counts are performed in order to get an adequate sample of moose to calculate ratios of bulls to cows and calves to cows. Composition counts conducted in 2001 in 2 traditional count areas, one around the Caribou Hills and the other south of the Anchor River, showed healthy bull:cow and calf:cow ratios (Table 1).

MORTALITY

Harvest

Season and Bag Limit. The general season in Subunit 15C has been 20 August–20 September since 1993. Since 1987 the bag limit has been 1 bull with a spike or fork on at least 1 antler, or 50-inch antlers, or antlers with 3 or more brow tines on at least 1 side (SF/50).

The 5-year average reported harvest for 15C was 247 moose (Table 2).

Board of Game Action and Emergency Orders. The board has reauthorized the antlerless moose permits for the Homer area (DM549) each year since 1995. There were no other board actions for Subunit 15C during the reporting period.

Permit Hunts. Since 1987 there has been a Tier II subsistence hunt for one bull in a portion of Subunit 15C southwest of a line from Point Pogibshi to the point of land between Rocky and Windy Bay. No bulls have been taken during this season in the last 4 years (Table 3).

The antlerless hunt for moose near Homer was initiated in 1995 (DM549). No permits were issued in 2000 or 2001. In 2002, 50 permits issued resulted in a harvest of 24 cow moose (Table 3).

Hunter Residency and Success. The vast majority of hunters were residents of Unit 15 (Table 4). Success rate averaged 20% over the past 5 seasons (Table 4).

Harvest Chronology. The highest proportion of moose harvested throughout the season occurred during the first 6 days of the season (Table 5).

Transport Methods. Highway vehicles and 4-wheelers combined encompass the vast majority of transportation methods used by successful hunters (Table 6).

Other Mortality

Moose killed in Subunit 15C by motor vehicles averaged 72 annually over the last 5 years (Table 2). The high number of moose wintering within the Homer Bench continues to be habitat-limited during deep snow winters. The level of mortality for these moose during severe winters is probably high.

HABITAT

Assessment

Reduction of beetle-killed forest stands through salvage logging has been underway for more than a decade. Post-logging site preparation that encourages hardwood regeneration beneficial for moose habitat has been recommended to local foresters and has been conducted on some sites with apparent success. If site preparation is done properly, resulting in a healthy regeneration of hardwoods, habitat quality for moose will likely increase greatly. However, if site preparation is not conducted or done inadequately, blue-joint grass (*Calamagrostis canadensis*) will initially crowd out hardwood and spruce seedlings, creating less desirable moose habitat and slowing forest succession.

Enhancement

Mitigation funds stemming from the construction of the Bradley Lake Hydroelectric Project allowed for the creation of Kachemak Moose Habitat Inc., a group focused on improving and protecting moose habitat. Trustees for the group purchased 593 acres of land in the Fritz Creek drainage near Homer and continue to orchestrate land purchases and conservation easements to benefit moose habitat on the lower Kenai Peninsula.

CONCLUSIONS AND RECOMMENDATIONS

The bull:cow ratio was within the objective range of 15–20 bulls:100 cows. However, these ratios vary dramatically across count areas because of clustered distributions of postrut aggregations. Adequate bull:cow ratios are desired to minimize the length of the rut and ensure most cows conceive during their first estrous cycle (Schwartz et al. 1994). There are biological uncertainties regarding the movement of moose throughout the subunit. Movements to the Homer Bench appear to be dictated by snow depth, but it is not known what proportion of moose display this migratory behavior or the source locations for the migrants. Investigations into how movements on the lower peninsula contribute to the fitness of the migrants versus nonmigratory moose, a determination of animal locations across seasons, and other answers could contribute greatly to our knowledge of population dynamics of this population. These answers could help management actions for subpopulations of moose that are affected by severe winters and also clarify the bull:cow ratios in specific areas during the rut.

LITERATURE CITED

- GASAWAY, W. C., S. D. DUBOIS, D. J. REED AND S. J. HARBO. 1986. Estimating moose population parameters from aerial surveys. Biological Papers of the University of Alaska, Institute of Arctic Biology, No. 22. 108pp.
- SCHWARTZ, C. C., K. J. HUNDERTMARK AND E. F. BECKER. 1994. Growth of moose calves conceived during the first versus second estrus. *Alces* 30:91–100.
- U.S. DEPARTMENT OF AGRICULTURE, U.S. FOREST SERVICE, AND DEPARTMENT OF NATURAL RESOURCES-DIVISION OF FORESTRY. February 2002. Forest Insect and Disease Conditions in Alaska-2002, General Technical Report R10-TP-113.
- VER HOEF, J.M. 2001. Predicting finite populations from spatially correlated data. 2000 Proceedings of the section on Statistics and the Environment of the American Statistical Association, pp93–98.

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Table 1 Unit 15C fall aerial moose composition counts and estimated population size, 1998–2003

Regulatory year	Bulls: 100 Cows	Yearling bulls: 100 Cows	Calves: 100 Cows	Calves (%)	Adults	Total Moose observed	Estimated Population size
1998–1999 ^a				20	380	474	2300–3000
1999–2000 ^b	27	7	18	12	506	578	2500–3000
2000–2001 ^a				22	256	329	2500–3000
2001–2002 ^c	19	8	31	21	958	1207	2508–3454
2002–2003	No Surveys						2500–3500

^a Summary of late winter composition counts; sex of adults could not be distinguished

^b Summary of composition counts

^c Estimates from geostatistical census method, estimated population size shown = 95% CI

Table 2 Unit 15C moose general season harvest and accidental death, 1998–2003

Regulatory year	Hunter Harvest							Accidental death			Total
	Reported				Estimated			Road	Train	Total	
	M	F	Unk.	Total	Unreported	Illegal	Total				
1998–1999	279	0	1	280			30	76	--	76	386
1999–2000	167	0	4	171			30	59	--	59	260
2000–2001	204	0	4	208			30	58	--	58	296
2001–2002	309	1	3	313			30	87	--	87	430
2002–2003	257	3	2	262			30	78	--	78	370

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 3 Unit 15C moose harvest data by permit hunt, 1998–2003

Hunt Nr. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent successful hunters	Bulls	Cows	Unk	Total harvest
TM549 ^a Point Pogibshi	1998–1999	4	0	50	2	0	0	2
	1999–2000	4	25	0	0	0	0	0
	2000–2001	4	0	0	0	0	0	0
	2001–2002	4	25	0	0	0	0	0
	2002–2003	4	25	0	0	0	0	0
DM549	1998–1999 ^b	20	24	21	0	11	0	11
	1999–2000	35	26	27	0	7	0	7
	2000–2001	0						0
	2001–2002	0						0
	2002–2003	50	18	58	0	24	0	24

^a Tier II moose hunt for any bull

^b Includes DM550-late season permits

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 4 Unit 15C moose hunter residency and success for the general season, 1998–2003

Regulatory year	Successful				Unsuccessful				Total hunters
	Local ^a resident	Nonlocal resident	Nonresident	Total ^b (%)	Local ^a resident	Nonlocal resident	Nonresident	Total ^b	
1998–1999	253	23	2	280 (21)	903	110	16	1032	1312
1999–2000	145	14	10	171 (15)	875	109	8	995	1166
2000–2001	178	25	5	208 (18)	836	107	24	976	1184
2001–2002	258	39	13	313 (25)	785	132	36	960	1273
2002–2003	226	28	7	262 (20)	873	127	39	1040	1302

^a Local = residents of Unit 15

^b Includes unspecified residency

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 5 Unit 15C moose general season harvest chronology (% of harvest), 1998–2003

Regulatory year	Harvest periods						Unknown	<i>n</i>
	8/20–25	8/26–8/31	9/1–9/5	9/6–9/10	9/11–9/15	9/16–9/20		
1998–1999	32	10	12	13	11	17	5	280
1999–2000	28	11	11	18	12	16	5	171
2000–2001	28	13	18	12	10	16	4	208
2001–2002	27	12	13	16	12	15	5	313
2002–2003	38	10	8	9	12	16	6	262

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 6 Unit 15C moose general season transport methods (% of harvest), 1998–2003

Regulatory year	Percent of harvest							Unknown	<i>n</i>
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle		
1998–1999	1	6	2	35	0	6	45	5	280
1999–2000	1	8	2	39	0	7	40	4	171
2000–2001	<1	13	4	45	0	7	26	4	208
2001–2002	2	9	3	43	0	5	33	4	313
2002–2003	0	6	4	42	0	6	39	3	262

All data has been updated from the ADF&G online database: WildlifeInfoNet

MOOSE MANAGEMENT REPORT

From: 1 July 2001

To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 16A (1850 mi²)

GEOGRAPHIC DESCRIPTION: West side of Susitna River (Kahiltna River to Chulitna River)

BACKGROUND

The moose population in Subunit 16A has been known to fluctuate greatly due to severe winters. Griese (1996) described significant winter die-offs of moose occurring at least once each decade beginning with the 1950s. The winter of 1989–90 caused 30–40% mortality from malnutrition, highway accidents, and predation facilitated by deep snows. Recovery from the resulting low density was slowed by subsequent deep-snow winters of 1990–91, 1992–93 and 1994–95 and by increasing predator populations.

Subunit 16A shares land within Denali National Park and Denali State Park. Access is limited to a few points from the Parks Highway, Petersville Road or Oilwell Road. Boats or 4-wheelers are then used to access more remote portions of the unit. Since Subunit 16A was separated from Subunit 16B in 1973, historical annual hunter harvest fluctuated as a result of variable moose densities, availability of cow moose hunts and improved hunter access (Griese 1996). Harvest numbers ranged from a high of 308 (1984) to a low of 37 (1990). The annual harvest has averaged 157 bulls in the past 5 seasons (1998–2002).

Starting in 1993, the bull harvest during the general season was restricted to moose with antlers having a spike or fork on at least 1 side or a minimum of 3 brow tines on at least 1 side or a minimum width of 50 inches. This selective harvest strategy is referred to as “spike-fork/50-inch” (SF50) (Schwartz et al. 1992).

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Maintain and enhance the moose population to provide for high levels of human consumptive use.
- Provide maximum opportunity to participate in hunting moose.
- Enhance wildlife viewing opportunities within state and national parks.

MANAGEMENT OBJECTIVES

- Attain a population of 3500–4000 moose, with a sex ratio of 20–25 bulls:100 cows during the rut.
- Achieve an annual harvest of 190–360 moose.

METHODS

On 17–25 November 2000, we conducted a stratified-random-sample survey in Unit 16A (Becker and Reed 1990). We generated a population estimate and calculated age/sex statistics using MOOSEPOP (Becker and Reed 1990). We attempted to categorize antler size of bulls and identify brow-tine counts on bulls with 30-inch or larger antlers. The previous survey in this subunit was conducted in the fall of 1997.

The harvest was monitored with harvest reports. All harvest data were reviewed for accuracy and updated if necessary. Some figures may not match those previously reported. The Alaska Railroad Corporation provided numbers of moose killed by trains, and the Department of Public Safety provided numbers of moose killed by highway vehicles or in defense of life or property.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The population decreased about 33% between the fall surveys in 1997 (3636 ± 614 : 80% CI) and 2000 (2420 ± 528 : 80% CI) (Table 1). No surveys were attempted in 2002 because of poor weather and lack of snow. In 2003 management priority focused on GMU 16B, and a 16A survey was not attempted.

Population Composition

The composition assessed in 2000 included 28 bulls and 22 calves:100 cows, which is down from 33 bulls and 35 calves:100 cows found in 1997 (Table 1). We suspect the bull:cow ratios are probably lower due to the season extension but above the minimum objective of 20 per 100 cows.

MORTALITY

Harvest

Season and Bag Limit. The fall season was 10–17 August archery-only, 20 August–30 September general season for resident and nonresident hunters for both years. The bag limit was 1 bull with a spike or fork antler on at least 1 side, an antler spread at least 50 inches, or 3 or more brow tines on at least 1 side (SF/50).

The annual harvest has been relatively stable for the past 5 years, averaging 157 moose, below the harvest objective minimum (190–360) (Table 2). The lower harvest is likely due to lower moose densities and the elimination of the permit hunts (Table 3).

Board of Game Actions and Emergency Orders. In response to declining moose numbers and the public desire to eliminate permit hunts, the board eliminated the winter hunt (5–15 December) in

16A, and eliminated the any-bull permits (DM556). To replace some of the lost hunting opportunities, the general open season was extended 5 days to close 30 September. In addition, the 10–17 August archery-only hunt was created.

At the spring 2003 meeting, the board considered several proposals to change moose hunting and the SF/50 system; however, no changes were approved.

Hunter Residency and Success. The number of moose hunters in Subunit 16A averaged 900 during 2001–2003 (Table 3). The majority were not residents of Unit 16 (Table 3). Hunter success was 18% during 2001 and 16% during 2002. Both years were slightly higher than the 10-year average of 15%.

Harvest Chronology. No moose were taken in the archery-only season in either 2001 or 2002. Hunters generally waited until the end of the season to hunt in Subunit 16A, harvesting more than 50% of the general season moose during the last 10 days (Table 4).

Transport Methods. The elimination of the winter hunt in 2001–02 eliminated the use of snowmachines as a transportation method (Table 6). Four-wheelers and boats have accounted for a majority of the transportation type used by successful hunters in the past 10 seasons. In 1998 the department began tracking harvest by hunters from airboats. Since that time, up to 5 percent of the successful hunters have reported using airboats in 14B.

HABITAT

Enhancement

An 18,000-acre area east of the lower end of Kroto Creek (Deshka River) was prepared for a controlled burn in 1994 (W. Collins personal communication). The prescribed burn continues to be delayed because of concern for public criticism in the wake of the 1995 Miller's Reach/Big Lake wildfire and a lack of fire crew presence. It is unlikely this prescribed burn will take place.

Timber harvest has varied from year to year. Recently word of a new wood fiber market has stimulated interest from many in the industry. If this market should continue to develop, the potential for moose habitat improvement may increase.

The National Park Service has renewed interest in building a new access road and visitor center on the south side of Denali National Park. Construction of a visitor center and access road may have an impact on moose habitat and movement. More important, the associated infrastructure and industry development associated with this project may affect moose hunting and other consumptive uses in the area.

CONCLUSIONS AND RECOMMENDATIONS

The approximate 33% decline in the moose population between the 1997 and 2000 surveys is probably due to the winter conditions in 1999–2000 and an increase in wolf numbers (Masteller 2000). The harvest increased slightly in 2001 due to an extension of the general season, elimination of the any-bull permits, and/or a slight recovery in the moose population (Table 4). Hunter effort will probably continue to increase due to improved access within the unit. It is

unlikely the moose population will reach the objective levels until the predator population decreases, habitat quality improves, and we have mild winters with moderate snow depths.

LITERATURE CITED

- BECKER E. F. AND D. J. REED. 1990. A modification of a moose population estimator. *Alces* 26:73-79.
- GASAWAY W. C., S. D. DUBOIS, D. J. REED, AND S. J. HARBO. 1986. Estimating moose population parameters from aerial surveys. University of Alaska, Institute of Arctic Biology, Alaska Department of Fish and Game. Biological papers No. 22. Fairbanks, Alaska USA.
- GRIESE H. J. 1996. Unit 16A moose survey-inventory management report. Pages 183–191 *in* M. V. Hicks, editor. Moose survey and inventory management report, 1 July 1991–30 June 1993. Alaska Department Fish and Game, Federal Aid in Wildlife Restoration. Grants W-23-5, W-24-1 and W-24-2. Study 1.0. Juneau, Alaska USA.
- MASTELLER M. 2000. Game Management Unit 16 wolf management report. Pages 211–220 *in* M.V. Hicks, editor. Federal aid in wildlife restoration management report of survey-inventory activities, 1 July 1996–30 June 1999. Wolf. Alaska Department of Fish and Game. Grants W-27-1 and W-27-2. Study 14.0. Juneau, Alaska USA.
- SCHWARTZ C.C., K.J. HUNDERTMARK, AND T.H. SPRAKER. 1992. An evaluation of selective bull moose harvest on the Kenai Peninsula, Alaska. *Alces* 28:1–14.

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Table 1 Unit 16A fall aerial moose composition counts and estimated subpopulation sizes, 1990–2003

Regulatory year	Bull: 100 cows	Yearling bulls: 100 cows	Calves: 100 cows	Percent calves	Adults observed	Total moose observed	Moose /mi ²	Population estimate
1990–91 ^a	27	7	31	29	1105	1366	1.8	3123±289 ^b
1991–92 ^c	--	--	--	--	--	--	--	--
1992–93 ^d	36	11	32	19	779	963	1.7	2900 ± 564 ^b
1993–94 ^d	24	10	24	16	698	828	1.9	3284 ± 903 ^b
1994–95 ^e	36	11	33	19	804	981	--	3000–3,600
1995–96 ^c	--	--	--	--	--	--	--	--
1996–97 ^c	--	--	--	--	--	--	--	--
1997–98 ^d	33	12	35	21	974	1234	2.1	3636 ± 614 ^b
1998–99 ^c	--	--	--	--	--	--	--	--
1999–2000	--	--	--	--	--	--	--	--
2000–01 ^d	28	6	22	15	661	787	1.4	2420 ± 528
2001–02 ^c	--	--	--	--	--	--	--	--
2002–03 ^c	--	--	--	--	--	--	--	--
2003–04 ^c	--	--	--	--	--	--	--	--

^a Gasaway et. al. (1986) survey methodology

^b 80% C.I.

^c No surveys conducted

^d Becker and Reed (1990) survey methodology

^e Sex and age composition surveys

Table 2 Unit 16A annual moose harvest and accidental death, 1990–2003^a

Regulatory year	Reported				Estimated			Accidental ^d			Grand Total
	M	F	Unk	Total ^a	Unreported ^b	Illegal ^c	Total	Road	Other	Total	
1990–91	37	0	0	37	2	10	12	6	0	6	55
1991–92	135	0	3	138	7	15	22	15	0	15	175
1992–93	136	0	2	138	7	15	22	9	0	9	169
1993–94	96	0	2	98	10	20	30	9	0	9	137
1994–95	113	0	0	113	10	20	30	4	0	4	152
1995–96	133	0	0	133	8	25	33	15	0	15	181
1996–97	200	1	1	202	14	25	39	4	0	4	245
1997–98	197	0	1	198	14	25	39	14	0	14	251
1998–99	168	0	0	168	12	25	37	12	0	10	215
1999–2000	168	0	3	171	12	25	37	14	0	16	224
2000–01	139	0	1	140	10	25	35	20	0	20	195
2001–02	153	0	0	153	11	25	36	15	0	15	204
2002–03	153	0	1	154	11	25	36	12	0	12	202

^a All information in this table has been updated since last management report.

^b Derived by taking 5–10% of the reported kill 7% from 1996 to present

^c Includes moose taken in defense of life or property

^d Roadkill is minimum number and does not reflect moose hit and lost or unsalvageable.

Table 3 Unit 16A moose hunter residency and success, 1990–2003^a

Regulatory year	Successful						Unsuccessful					Total hunters
	Local ^b resident	Nonlocal resident	Non- resident	Unk	Total	(%)	Local ^b resident	Nonlocal resident	Non- resident	Unk	Total	
1990–91	4	32	1	0	37	(7)	23	430	9	12	474	511
1991–92	9	123	4	2	138	(16)	29	673	12	8	722	860
1992–93	7	126	4	1	138	(16)	34	631	24	21	710	848
1993–94	5	62	1	2	70	(11)	39	497	6	10	552	622
1994–95	6	55	2	1	64	(11)	32	458	8	4	502	566
1995–96	6	65	6	1	78	(11)	61	521	16	5	603	681
1996–97	14	120	4	1	139	(19)	54	514	13	6	587	726
1997–98	16	114	11	0	141	(18)	54	545	25	3	627	768
1998–99	6	110	2	2	120	(15)	55	573	19	7	654	774
1999–2000	14	115	9	4	142	(17)	42	645	18	10	715	857
2000–01	3	107	6	3	119	(12)	55	773	22	5	855	974
2001–02	12	131	10	0	153	(18)	40	649	19	5	713	866
2002–03	7	133	14	0	154	(16)	42	728	29	1	800	954

^a All information in this table has been updated since last management report.

^b Unit 16 residents

Table 4 Unit 16A moose harvest chronology^a by months of season, 1990–2003^b

	<u>August</u>			<u>September</u>					<u>November</u>	<u>December</u>			
Year	20–26	27–31	1–7	8–14	15–20	21–25	26–30	20–30	1–7	8–15	Unknown	Total	
1990–91 ^c	--	--	21	11	--	--	--	--	--	--	5	37	
1991–92 ^d	--	--	72	53	7	--	--	--	--	--	6	138	
1992–93 ^d	--	--	75	51	6	--	--	--	--	--	6	138	
1993–94 ^e	13	4	8	19	24	--	--	--	--	--	2	70	
1994–95 ^e	6	4	11	13	29	--	--	--	--	--	1	64	
1995–96 ^f	8	1	11	12	34	--	--	5	1	4	2	78	
1996–97 ^f	5	4	19	26	41	--	--	18	6	10	10	139	
1997–98 ^f	20	7	11	29	36	--	--	17	4	8	9	141	
1998–99 ^f	9	5	13	21	40	--	--	11	4	13	4	120	
1999–00 ^g	11	7	15	21	38	32	--	--	2	16	4	142	
2000–01 ^g	6	3	5	16	37	29	--	--	7	11	4	119	
2001–02 ^h	8	3	7	10	34	37	52	--	--	--	2	153	
2002–03 ^h	17	2	9	11	33	34	44				4	154	

^a Does not include harvest from drawing permit hunts

^b All information in this table has been updated since last management report.

^c Open season = 1–10 Sep

^d Open season = 1–15 Sep

^e Open season = 20 Aug–20 Sep (SF-50)

^f Open season = 20 Aug–20 Sep 20 (SF-50), 20 Nov–15 Dec (SF-only)

^g Open season = 20 Aug–25 Sep (SF-50), 1–15 Dec (SF-only)

^h Open season = 10–17 Aug (Archery-only), 20 Aug–30 Sep (SF-50). No moose harvested in 2001 or 2002

Table 5 Transport method used by successful moose hunters^a in Unit 16A, 1990–2003^b

Regulatory year	Percent of successful moose hunters									No. moose harvested
	Airplane	Horse	Boat	3- or 4- Wheeler	Snowmachine	ORV	Highway vehicle	Unk	Airboat	
1990–91	22	3	24	14	0	24	14	0		37
1991–92	15	0	25	30	0	11	17	1		138
1992–93	16	0	21	28	0	14	18	3		138
1993–94	13	0	23	34	0	11	19	0		70
1994–95	22	0	17	34	0	8	17	2		64
1995–96	12	0	19	19	3	15	31	1		78
1996–97	9	0	19	30	17	6	15	3		139
1997–98	9	0	15	34	16	6	15	4		141
1998–99	10	1	19	22	16	7	23	2	2	120
1999–00	7	1	25	39	6	3	17	2	1	142
2000–01	10	0	15	40	5	13	12	0	5	119
2001–02	10	0	25	38	0	8	16	1	3	153
2002–03	10	0	23	33	0	11	16	2	5	154

^a Does not include harvest from drawing permit hunts.

^b All information in this table has been updated since last management report.

MOOSE MANAGEMENT REPORT

From: 1 July 1991
To: 30 June 2003^a

LOCATION

GAME MANAGEMENT UNIT: 16B (10,405 mi²)

GEOGRAPHIC DESCRIPTION: West Side of Cook Inlet and Kalgin Island

BACKGROUND

Moose numbers probably exceeded 10,000 in Subunit 16B during the early 1980s (Griese 1996). Harkness (1993) speculated the population before the severe winter of 1989–90 was probably 8500–9500 moose. Following a 15–20% decline after the winter of 1989–90, moose numbers in the unit continued to decline in response to continued deep snow winters and growing predator influence (Griese 2000). Faro (1989) implied that predation on neonatal moose calves by bears influenced recruitment and caused the current declining trend. ADF&G biologist Thomas McDonough (unpublished data) estimated 150–200 wolves in the unit during the winter of 2001–02, up from the 120–140 wolves estimated in the fall 1998 (Masteller 2000).

Since 1972, when 16B was separated from 16A, hunter harvest of moose has declined from a high of 842 in 1973 to a low of 99 moose during a short 1990 season. Harvest in the 1990s averaged 249 moose per year. From 1962 to 1974, hunting seasons in 16B were liberal (20 Aug–30 Sep and 1–30 Nov season for either-sex moose). Through 1989, except 1975, an antlerless moose hunt was held during September. Increasing numbers of hunters and lower moose recruitment caused late season hunts to be converted to permit hunts beginning in 1983. Tier II permits were issued starting in 1990 to assure local residents an opportunity to meet subsistence needs.

Starting in 1993, the bull harvest during the general season was restricted to moose with antlers having a spike or fork on at least 1 side or a minimum of 3 brow tines on at least 1 side or a minimum width of 50 inches. This selective harvest strategy is referred to as “spike-fork-50-inch” (SF/50) (Schwartz et al 1992).

The Kalgin Island moose population resulted from translocation of calves during 1957–59. Numbers grew to a density of 7 moose/mi² during 1981 (Taylor 1983), but was reduced to approximately 1 moose/mi² by 1985. High moose densities severely degraded habitat, and the department adopted restrictive population objectives to maintain moose densities at less than 1 moose/mi² while vegetation recovered (Faro 1990). In 1999 the Board of Game adopted an any-

^a This unit report also includes data collected outside the reporting period at the discretion of the reporting biologist.

moose registration hunt 20 August–30 September. The board later shortened the season to 20 September to relieve conflicts between hunters and other occupants of the island.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Maintain and enhance the moose population to provide for high levels of human consumptive use.

MANAGEMENT OBJECTIVES

Unit 16B (excluding Kalgin Island)

- Maintain a moose population of 6500–7500 moose and 20–25 bulls:100 cows.
- Achieve a harvest of 310–600 moose

Kalgin Island

- Maintain a posthunt population of 20–40 moose with at least 15 bulls:100 cows

METHODS

Because of its size, we divide 16B into 3 zones (north, middle, and south) for survey purposes. The northern area is described as 16B north of the Skwentna River. The middle area is that area north of the Beluga River and Beluga Lake and south of Skwentna River. The southern portion is all of 16B south of Beluga River and Beluga Lake except Kalgin Island. We have conducted various surveys (Gassaway et. al. 1986, Becker and Reed 1990) of each of these units as funding and priority allows (Table 1).

For this reporting period, surveys were conducted on Kalgin Island in October 2001 and most of the mainland, but canceled in 2002 because of poor survey conditions.

We collected harvest and hunter effort data from registration (Kalgin), general harvest and Tier II permit reports.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population size

We last estimated the 16B North population at 1187 ± 182 (80% C.I.) in fall 2001 (Table 1). The 16B Middle population was 1836 ± 267 (80% C.I.) in fall 2001 (Table 1). A recent census of Unit 16B South has not been completed; however, an estimate was attempted in 2001 when most of the area was surveyed. That estimate was 718 moose. The Unit 16B fall population in 2001 was likely 3700–4000 moose. The latest survey on Kalgin Island conducted after the hunt in 2003 showed at least 125 moose.

Population Composition

The 16B North composition assessed in 2001 was 40 bulls and 14 calves:100 cows (Table 1). The 16B Middle composition assessed in 2001 included 32 bulls and 10 calves:100 cows (Table

1). The 16B South composition was 31 bulls and 13 calves:100 cows in 2001 (Table 1). Kalgin Island in 2001 had 60 bulls and 80 calves:100 cows.

MORTALITY

Harvest

Season and Bag Limit.

The general season was closed in both 2001 and 2002. Four hundred Tier II permits were issued for 20 August–30 September (SF/50) and 15 November–28 February (any bull) periods. These Tier II hunts are divided into 3 units (TM565, TM567, TM569). The registration hunt for any moose on Kalgin Island shortened to 20 August–20 September in 2001 and 2002.

The harvest decreased dramatically in 2001 due to the closure of the general season (Table 2). The Tier II harvest increased due to the greater allotment of permits issued in 2001 and 2002 (Table 3). The harvest on Kalgin Island decreased when the season was shortened in 2001 (Table 3).

Board of Game Actions and Emergency Orders. At the March 2001 meeting, the board eliminated the general season in 16B because of the continuing decline in moose numbers unitwide. Responding to local advisory committee recommendations, the board increased the population objective to 6500–7500 from 5500–6500. The board also shortened the hunt on Kalgin Island by 10 days to relieve conflicts between hunters and other occupants of the island. The board revisited the moose season in March of 2003. At that meeting it returned to a 20-day Tier I (resident-only) season after ruling that enough moose were available for harvest in the unit.

Hunter Residency and Success. The general season was closed during this reporting period (Table 4).

Harvest Chronology. The general season was closed during this reporting period (Table 5).

Transport Methods. The lack of road accessibility to the unit is reflected by the dominance of aircraft and boat transportation used by successful hunters. The general season was closed during this reporting period (Table 6).

Other Mortality

The severe winter of 1999–2000 negatively impacted the moose population. In midwinter we observed moose floundering in snow depths exceeding 5 feet (Griese 2000). As the winter progressed, rain fell giving the surface an ice crust that facilitated easy wolf travel and complicated moose movement. Recent survey results reflect a continued population decline. The effects of predation by wolves and bears are suspected on mainland 16B as assessed from low calf recruitment in the fall. A wolf survey conducted in January and February 2002 estimated the minimum number of wolves in Unit 16B at 150–200, up dramatically from the 120–140 wolves estimated in the fall 1998 (Masteller 2000).

Due to the continued decline in moose numbers throughout 16B, ADF&G staff drafted a proposal to close the federal subsistence hunt for cow moose. The Federal Subsistence Board approved this proposal in May of 2004.

CONCLUSIONS AND RECOMMENDATIONS

The moose population in Unit 16B was below objective levels for this reporting period. Our estimate of 3700–4000 moose is below the minimum objective of 6500 and below what we believe the habitat could support. Current season and bag limit structure will allow bull:cow ratios to remain above minimum objective levels. If the moose density remains low, we should be cautious to maintain bull:cow ratios at or above the upper end of our objective of 25 bulls:100 cows.

Additional information is needed to better manage moose in 16B. Future efforts should be directed at gaining accurate and precise estimates of wolf and bear populations. A long-term monitoring program of the unit's moose browse will provide needed empirical data to further clarify whether predators or habitat is more limiting in this declining moose population. Prescribed burns should be considered for habitat enhancement, since much of the unit contains mature stands of birch, aspen and spruce forest.

LITERATURE CITED

- BECKER, E. F. AND D. J. REED. 1990. A modification of a moose population estimator. *ALCES* 26:73–79.
- FARO, J. B. 1989. Game Management Unit 16 moose survey-inventory progress report. Pages 156–166 *in* S. O. Morgan, editor. Annual report of survey-inventory activities, Part VIII. Moose. Vol. XIX. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration Progress Report Project W-23-1, Study 1.0. Juneau, Alaska USA.
- 1990. Game Management Unit 16 moose survey-inventory progress report. Pages 165–176 *in* S. O. Morgan, editor. Annual report of survey-inventory activities, Part VIII. Moose. Vol. XX. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration Progress Report Project W-23-2, Study 1.0. Juneau, Alaska USA.
- GASAWAY, W. C., S. D. DUBOIS, D. J. REED, AND S. J. HARBO. 1986. Estimating moose population parameters from aerial surveys. University of Alaska, Institute of Arctic Biology Alaska Department of Fish and Game. Biological papers No. 22. Fairbanks, Alaska USA.
- GRIESE, H.J. 1996. Game Management Unit 16B moose management report. Pages 208–221 *in* M. V. Hicks, editor. Management report of survey-inventory activities, 1 July 1993–30 June 1995. Moose. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration Progress Report. Grants W-24-2 and W-24-3. Study 1.0. Juneau, Alaska USA.

- . 2000. Game Management Unit 16B moose management report. Pages 224–236 *in* M. V. Hicks, editor. Management report of survey-inventory activities, 1 July 1997–30 June 1999. Moose. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration Progress Report. Grants W-27-1 and W-27-2. Study 1.0. Juneau, Alaska USA.
- HARKNESS, D. B. 1993. Game Management Unit 16 moose survey-inventory management report. Pages 182–190 *in* S. M. Abbott, editor. Survey-inventory management report, 1 July 1989–30 June 1991. Moose. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration Progress Report. Grants W-23-3 and W-23-4. Study 1.0. Juneau, Alaska USA.
- MASTELLER. 2000. Game Management Unit 16 wolf management report. *In* M. V. Hicks, editor. Management report of survey-inventory activities, 1 July 1997–30 June 1999. Wolf. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Progress Report. Grants W-27-1 and W-27-2. Juneau, Alaska USA.
- SCHWARTZ, C.C., K.J. HUNDERTMARK, AND T.H. SPRAKER. 1992. An evaluation of selective bull moose harvest on the Kenai Peninsula, Alaska. *Alces* 28:1–14.
- TAYLOR, W. P. 1983. Unit 16B, Kalgin Island, moose survey-inventory progress report. Pages 70–72 *in* J. A. Barnett, editor. Annual report of survey-inventory activities. Part II. Moose. Vol. XIII. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration Progress Report Project. W-22-1, Job 1.0. Juneau, Alaska USA.

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Table 1 Unit 16B fall aerial moose composition counts and estimated subpopulation sizes, 1990–2003

Reg. year	Area	Date	Bulls: 100 cows	Yearling bulls: 100 cows	Calves: 100 cows	Percent calves	Adults	Total moose observed	Moose observed: mi ²	Population estimate
1990–91	Northern ^a	11/21–27	32	9	23	15	650	745	1.4	2650±412 ^b
	Middle ^a	12/08–21	34	5	25	16	673	789	1.4	3824±314 ^b
1991–92 ^c			--	--	--	--	--	--	--	--
1992–93	Southern ^d	12/15	36	5	12	12	109	124	--	--
1993–94	Northern ^e	11/15–20	50	10	16	10	374	416	1.1	2006±432 ^b
	Middle ^e	11/28–12/3	21	9	25	17	391	463	1.4	3653±1965 ^b
1994–95	Northern ^f	11/13–18	42	10	12	7	405	431	1.0	--
	Middle ^f	11/18–25	26	4	24	16	314	374	--	--
	Southern ^g	11/29–12/2	25	5	25	17	220	261	1.0	810–1210
	Kalgin Is. ^h	11/18	35	15	65	33	27	40	1.7	55–75
1995–96	Northern ^d	2/27–28	--	--	--	7	298	321	--	--
	Middle ^d	2/27–28	--	--	--	12	855	969	--	--
	Southern ^d	2/29–3/3	--	--	--	6	505	537	0.8	1081±145 ^b
	Kalgin Is. ^f	2/09	--	--	--	28	26	36	1.5	60–90
1996–97	Northern ^a	11/1–2	38	7	23	14	422	484	1.2	1912±325
	Southern ^d	11/8–9	32	7	14	10	305	338	--	--
	Kalgin Is. ^f	11/8	67	27	60	26	25	35	1.5	80–110
1997–98	Southern ^d	11/25, 12/3	37	8	13	9	544	591	--	--
	Kalgin Is. ^f	2/27	--	--	--	23	17	22	0.9	100–130
1998–99	Southern ^d	11/22	35	7	8	6	337	357	--	--
	Kalgin Is. ^h	12/7	27	9	36	29	82	116	5.0	130–150
1999–00	Middle ^a	11/22–27	28	2	9	7	587	631	1.3	3314±489 ^b
	Southern ^d	11/15–22	38	4	8	6	432	458	--	--
	Kalgin Is. ^h	01/5	--	--	--	24	38	50	2.2	60–80

Table 1 Continued

Reg. year	Area	Date	Bulls: 100 cows	Yearling bulls: 100 cows	Calves: 100 cows	Percent calves	Adults	Total moose observed	Moose observed /mi ²	Population estimate
2000–01	Northern ^e	11/20–22	39	5	7	5	253	268	0.6	909±184
	Southern ^d	12/16	--	--	--	--	85	98	--	--
	Kalgin Is. ^h	12/12	--	--	--	30	35	50	2.2	80–100
2001–02	Northern ^e	11/5–7	40	7	14	9	393	438	0.8	1187±182
	Middle ^e	11/8–11	32	4	10	7	494	537	0.7	1836±267
	Southern ^d	10/30–11/4	31	3	13	9	539	594	--	700–850
	Kalgin Is. ^h	10/22	--	--	--	33	64	96	4.2	110–140
2002–03 ^c										
2003–04	Northern ^e	11/24–12/6	35	7	17	9		326		898±163
	Middle ^c									
	Southern ^d		46	17	23	14		154		
	Kalgin Is. ^h	12/1	38	--	89	39	76	125	5.7	125+

^a Gasaway et. al. (1986) random stratified survey^b 80% confidence intervals^c No survey this year^d Trend area composition survey (2–4 min./mi²)^e Becker survey (Becker and Reed 1990)^f Sex and age composition survey (4–6 min./mi²)^g J. VerHoef's regression sampling method for 1/3 of area (612 ± 151 (80% CI)) plus 350–550 estimated for remainder of area^h Sex and age composition survey (6–8 min./mi²)

Table 2 Unit 16B annual moose harvest and accidental death, 1990–2003^a

Regulatory year	Reported ^b				Estimated			Accidental			Grand Total
	M	F	Unk	Total	Unreported	Illegal ^c	Total	Road	Other	Total	
1990–91	93	5	1	99	10	25	35	2	0	2	136
1991–92	256	0	0	256	15	25	40	1	0	1	303
1992–93	233	2	3	238	15	25	40	0	0	0	278
1993–94	154	21	0	175	10	35	45	0	0	0	221
1994–95	230	0	0	230	15	35	50	2	3	5	285
1995–96	186	10	3	199	10	25	35	0	0	0	235
1996–97	293	9	3	305	20	25	45	1	0	1	351
1997–98	315	15	1	331	20	25	45	1	0	1	374
1998–99	289	7	1	297	20	30	50	0	0	0	346
1999–00	297	50	4	351	20	25	45	0	0	0	396
2000–01	264	42	0	306	20	25	45	0	0	0	351
2001–02	131	22	1	154	20	25	45	0	0	0	199
2002–03	88	16	1	105	20	25	45	0	0	0	150

^a All information in this table has been updated since last management report.

^b Includes all reported harvest including federal subsistence.

^c Includes moose taken in defense of life or property

Table 3 Unit 16B moose harvest data by permit hunt, 1993–2003

Hunt Number ^a	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Harvest			
						Bulls	Cows	Unk	Total
TM565	1993–94	30	13	10	73	7	15	0	22
	1994–95	138	32	23	40	55	0	0	55
	1995–96	140	40	46	10	14	0	0	14
	1996–97	141	26	38	35	49	0	0	49
	1997–98	139	30	32	37	50	1	0	51
	1998–99	140	21	39	37	52	0	0	52
	1999–00	140	22	31	41	57	0	0	57
	2000–01	140	16	54	31	43	0	0	43
	2001–02	140	29	41	30	42	0	0	42
	2002–03	141	24	52	24	33	0	0	33
TM567	1993–94	15	33	0	67	4	6	0	10
	1994–95	59	19	14	66	39	0	0	39
	1995–96	60	30	58	7	4	0	0	4
	1996–97	60	18	30	49	30	0	0	30
	1997–98	59	12	38	48	29	0	0	29
	1998–99	60	17	37	42	25	0	0	25
	1999–00	60	13	18	58	34	0	0	34
	2000–01	60	25	37	38	23	0	0	23
	2001–02	160	31	41	28	45	0	1	46
	2002–03	160	36	56	8	13	0	0	13

Table 3 Continued

Hunt Number ^a	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Harvest			
						Bulls	Cows	Unk	Total
TM569	1993–94	60	45	35	20	12	0	0	12
	1994–95	58	43	29	17	10	0	0	10
	1995–96	60	32	47	18	8	1	2	11
	1996–97	60	45	25	28	16	0	1	17
	1997–98	59	53	24	17	9	1	0	10
	1998–99	60	30	42	25	15	0	0	15
	1999–00	60	35	37	20	12	0	0	12
	2000–01	60	50	42	8	5	0	0	5
	2001–02	100	42	27	31	32	0	0	32
	2002–03	100	24	54	22	21	0	0	21
DM571/ RM572	1995–96	50			20	0	9	1	10
	1996–97	60			20	2	8	0	10
	1997–98	60			20	1	11	0	12
	1998–99	40			18	0	7	0	7
	1999–00	437	37	42	18	30	50		80
	2000–01	355	32	50	18	22	42		64
	2001–02	142	30	48	22	10	21		31
	2002–03								

^aTM = Tier II permit, RM = registration permit, DM= drawing permit

Table 4 Unit 16B moose hunter^a residency and success 1990–2003^b

Regulator year	Successful						Unsuccessful						Total hunters
	Local ^c resident	Nonloca resident	Nonres.	Unk	Total	(%)	Local ^c resident	Nonloca resident	Nonres.	Unk	Total	(%) ^b	
1990–91	3	64	2	0	69	(16)	24	327	1	0	352	(840)	419
1991–92	13	153	35	3	204	(26)	24	514	41	7	586	(74)	780
1992–93	14	135	38	5	192	(25)	26	480	54	11	571	(75)	763
1993–94	15	79	36	1	131	(23)	28	362	40	9	439	(77)	570
1994–95	5	83	38	1	126	(23)	23	353	35	2	413	(77)	539
1995–96	5	114	38	3	160	(25)	33	407	44	5	489	(75)	649
1996–97	12	145	39	3	199	(30)	24	412	31	0	467	(70)	666
1997–98	14	163	48	4	229	(32)	25	416	36	2	479	(68)	708
1998–99	7	153	37	1	198	(25)	25	497	53	4	579	(75)	777
1999–00	7	115	40	6	168	(22)	27	489	62	18	596	(78)	764
2000–01	10	129	30	2	171	(22)	20	534	60	4	618	(78)	789
2001–02 ^d	--	--	--		--	--	--	--	--	--	--	--	--
2002–03 ^d	--	--	--		--	--	--	--	--	--	--	--	--

^a Does not include individuals participating in permit hunts

^b All information in this table has been updated since last management report.

^c Unit 16 residents

^d No general open season

Table 5 Unit 16B moose harvest chronology^a by months of season, 1990–2003^b

Year	August		September					January	Unknown	Total
	20–26	27–31	1–7	8–14	15–20	21–25	26–30	10–23		
1990–91 ^c	--	--	47	10	--	--	--	--	12	69
1991–92 ^d	--	--	62	57	77	--	--	--	8	204
1992–93 ^d	--	--	52	71	60	--	--	--	9	192
1993–94 ^e	11	5	12	30	57	--	--	9	7	131
1994–95 ^f	16	11	17	41	37	--	--	--	4	126
1995–96 ^g	15	5	15	28	38	23	33	--	3	160
1996–97 ^g	9	16	18	30	45	28	48	--	5	199
1997–98 ^g	11	12	22	27	63	35	49	--	9	229
1998–99 ^g	14	8	18	30	33	38	50	--	7	198
1999–00 ^h	5	1	10	28	35	37	45	--	7	168
2000–01 ^h	3	5	14	19	55	34	37	--	4	171
2001–02 ⁱ	--	--	--	--	--	--	--	--	--	--
2002–03 ⁱ	--	--	--	--	--	--	--	--	--	--

^a Does not include harvest from permit hunts

^b All information in this table has been updated since last management report.

^c Open season = 1–10 Sep

^d Open season = 1–20 Sep

^e Open season = 20 Aug–20 Sep (SF/50), 10–23 Jan (SF/50 – Res. only)

^f Open season = 20 Aug–20 Sep (SF/50)

^g Open season = 20 Aug–30 Sep (SF/50); Kalgin Island = 20 Aug–20 Sep (Any bull)

^h Open season = 20 Aug–30 Sep (SF/50)

ⁱ No general open season

Table 6 Transport method used by successful moose hunters^a in Unit 16B, 1990–2003^b

Regulatory year	Percent of successful moose hunters									No. moose harvested
	Airplane	Horse	Boat	3-or 4- Wheeler	Snowmachine	ORV	Highway vehicle	Airboat	Unk	
1990–91	65	0	19	1	3	3	4		4	69
1991–92	68	1	22	4	0	1	2		2	204
1992–93	64	3	19	4	0	3	2		5	192
1993–94	56	11	21	1	6	1	0		4	131
1994–95	60	11	17	3	1	1	1		6	126
1995–96	67	9	19	3	0	1	0		1	160
1996–97	61	9	18	6	1	3	1		3	199
1997–98	62	6	19	4	0	2	3		3	229
1998–99	56	7	23	8	0	2	1	2	2	198
1999–00	60	5	19	10	0	2	2	0	2	168
2000–01	65	3	20	7	0	1	2	1	2	171
2001–02 ^c	--	--	--	--	--	--	--	--	--	--
2002–03 ^c	--	--	--	--	--	--	--	--	--	--

^a Does not include harvest from permit hunts

^b All information in this table has been updated since last management report.

^c No general open season

MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 17 (18,800 mi²)

GEOGRAPHIC DESCRIPTION: Northern Bristol Bay

BACKGROUND

Moose are relatively new inhabitants in the Bristol Bay area, possibly migrating into the area from middle Kuskokwim River drainages during the last century. Until recently, populations were low, and moose primarily inhabited the Nushagak/Mulchatna River system. Local residents harvested moose opportunistically; however, caribou, reindeer, bears, and beaver were historically the main sources of game meat. The department began collecting data on the Unit 17 moose population in 1971. At that time, Faro (1973) reported that moose were not abundant in the unit and that animals close to the villages were subject to heavy hunting pressure.

Hunting seasons have varied over the years, but the bag limit has always been restricted to bulls. In the past, a general disregard for seasons and bag limits by unit residents was suspected to be the principal factor contributing to low densities of moose in the unit (Taylor 1990).

In the last 2 decades moose populations throughout Unit 17 have increased substantially in number and range. Reasons for this increase include moderate snowfalls in several successive winters and decreased human harvest of female moose. The reduction in the female harvest was caused in part by a positive response by unit residents to department education efforts and an abundance of an alternative big game resource as the Mulchatna caribou herd grew and extended its range (Van Daele 1995).

Moose are now common along the Nushagak/Mulchatna Rivers and all of their major tributaries. They are also throughout the Wood/Tikchik Lakes area. Moose have successfully extended their range westward into the Togiak and Kulukak River drainages of Subunit 17A, where a viable population has become established.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

SUBUNIT 17A

Manage for a minimum population of 300 moose and a target population of 1100–1750 moose.

SUBUNIT 17B

Manage for a population of 4900–6000 moose with a human use objective of 200–400 moose. Achieve and maintain a density of 1 moose/mi² on habitat considered good moose range.

SUBUNIT 17C

Manage for a population of 2800–3500 moose with a human use objective of 165–350 moose. Maintain a minimum density of 0.5 moose/mi²

METHODS

Moose populations in Subunit 17A were monitored in cooperation with personnel from the Togiak National Wildlife Refuge (TNWR). Movements along the border of Subunits 17A and 17C were monitored during a radiotelemetry study from 1989 to 1994. In March 1998, 36 moose were radiocollared in 17A to study movements and population parameters (Aderman, et. al. 1999). Additional moose have been radiocollared in 17A each year since. Late-winter aerial surveys of 17A were conducted during this reporting period.

Aerial surveys of trend count areas in Subunits 17B and 17C have been used in the past to sample sex and age composition and to collect data on population trends in representative portions of the unit. Optimal survey periods were 1 Nov–15 Dec when moose were established on their winter ranges and bulls still had their antlers. In most years, however, suitable weather, snow cover, and survey aircraft were not available during the optimal period. Late-fall composition surveys in the upper Nushagak and Mulchatna River drainages were initiated in 1992–93 to investigate population trends, but have not been conducted since 1998.

Moose population estimation surveys have been attempted 6 times in portions of Subunits 17B and 17C. A portion of 17C was surveyed in 1983. In 1987 a portion of the upper Mulchatna River area in 17B was surveyed, and in 1995 western 17C, along with most of 17A, were surveyed. In March 1999 a population estimation survey for 17C was completed using a spatial statistics stratification model. In March 2001 a population estimation survey for the western portion of 17B (upper Nushagak River drainage) was completed using a spatial statistics stratification model. In March 2002 a population estimation survey for the eastern portion of Unit 17B (Mulchatna drainage) was completed using a spatial statistics stratification model.

We collected harvest data by means of harvest ticket reports and registration permit reports. Nonreporting hunters were contacted by telephone and were sent reminder letters. We monitored harvest and cooperated with enforcement efforts of Alaska Bureau of Wildlife Enforcement during the hunting season.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

POPULATION SIZE

Aderman et. al. (1995) estimated there were approximately 100 moose in Subunit 17A and the portion of 17C surveyed in 1995. In March 2000 and 2001, department staff and TNWR staff

surveyed 17A, east of and including the Matogak River drainage and north of the Nushagak Peninsula, counting 422 moose in 2000 and 471 in 2001. A survey conducted in February 2002 indicated a minimum population of 652 moose in 17A (Aderman and Woolington 2003). The present population size in 17A probably exceeds 700 moose. We have seen a continued increase in the number of moose in the unit since the early surveys.

The moose population in Subunit 17B was estimated to be 2500–3000 moose in 1987 (Taylor 1990). That estimate was based on extrapolations from a survey in the upper Mulchatna River area. Assuming that 50% of the unit is good moose habitat, we established the management goal for the unit at 4900 moose. Survey data for this unit were inconsistent and difficult to interpret. Taylor (1988) noted that trend count data were of limited use in estimating moose density in Unit 17, and periodic population estimation surveys were the only objective method of assessing trends. Lacking such information, we conducted late winter surveys of major drainages to investigate population trends between 1992 and 1997. From the available data, it appeared the moose population size in the unit was stable to increasing. In March 2001, I conducted a moose population estimation survey in the western portion of 17B, including the upper Nushagak River drainage and drainages of Lake Kulik and Lake Beverley. Ninety-five of 441 sample units were surveyed, yielding an extrapolated estimate of 1202 (± 141 at 90% CI) moose, including 61 (± 9 at 90% CI) calves (5.1% of moose). In March 2002, I conducted a moose population estimation survey in the eastern portion of 17B (Mulchatna River drainage). One hundred of 646 sample units were surveyed, yielding an extrapolated estimate of 1953 (± 254 at 90% CI), including 76 (± 12 at 90% CI) calves (3.9% of total moose). These estimates indicate the 17B moose population is less than the population management objective.

The moose population in 17C was estimated to be 1400–1700 moose in 1987 (Taylor 1990). That estimate was based on extrapolations from the moose survey conducted in 1983. The management objective for the unit is a minimum of 2800 moose. In March 1999, I conducted a moose population estimation survey for 17C north of the Igushik River. One hundred and three (103) of 774 sample units were surveyed, yielding an extrapolated estimate of 2955 (± 488 at 90% CI) moose, including 435 (± 76 at 90% CI) calves (14.7% of moose). This estimate indicates the 17C moose population was within the population management objective range.

POPULATION COMPOSITION

Bull:cow ratios in all areas of Unit 17 have historically been high, but no composition data were collected during this reporting period. Calf production and survival have fluctuated between areas and years. In 1997–98, late winter survey data indicated minimum calf percentages of 19.4% in the Mulchatna drainages and 24.9% in the upper Nushagak drainages. The 1999 survey indicated a minimum calf percentage of 14.7% in Unit 17C. The 2001 survey indicated a minimum calf percentage of 5.1% in western Unit 17B, and the 2002 survey indicated a minimum calf percentage of 3.9% in eastern Unit 17B.

DISTRIBUTION AND MOVEMENTS

Much of Unit 17 is wet or alpine tundra, and moose are located predominantly along the riparian areas. We know little about specific movement patterns, except that they are

influenced primarily by the rutting season in late September and by snow conditions throughout the winter.

Data from a joint ADF&G–TNWR radiotelemetry study indicated most moose radiocollared in western 17C stayed in that area, but there was some movement into 17A. One radiocollared moose and her calf moved from Weary River to Kulukak River (Jemison 1994). During the February 1995 population estimation survey, 29 moose moved into 17A from the upper Sunshine Valley in 17C (Aderman et al. 1995). Aderman et al. (2000) found that in 17A, some radiocollared moose remained in the same range during winter and summer, while others used different ranges during those seasons. Since then, moose radiocollared in 17A have moved into western 17A and the southern part of Unit 18. These moose seem to be part of a continued westward expansion of moose into previously unpopulated moose habitat.

MORTALITY

HARVEST

Season and Bag Limit. Subunit 17A was open to resident/subsistence hunters only by registration permit 25 Aug–20 Sep (RM573). Registration permit holders could take one bull.

The general moose hunt in Subunits 17B and 17C was open for resident hunters 1–15 September. The bag limit for residents was 1 bull with spike/fork or 50" antlers or with 3 or more brow tines on at least 1 side. The general moose hunt in 17B for nonresident hunters was open 5–15 September. The bag limit for nonresident hunters was 1 bull with 50" or greater antler spread or with 4 or more brow tines on at least 1 side. Nonresidents were prohibited from hunting in 17C.

The fall resident-only registration hunt in 17B and 17C (RM583) was open 20 August–15 September. Registration permit holders could take one bull.

The winter resident-only registration hunt in 17B and 17C (RM585) was open 1–31 December. Registration permit holders could take one bull. Areas that remained closed during this winter hunt were the Mulchatna River drainage upstream and including the Chilchitna River (in 17B), and the Iowithla River drainage, Sunshine Valley, and all portions of the unit west of the Wood River and south of Aleknagik Lake (in 17C).

Registration hunt RM 573 permits were valid only in 17A, and were available to any Alaska resident who applied in person at Togiak (5 Aug–25 Sep). Registration hunt RM583 and RM585 permits were valid for both 17B and 17C. Permits were available to any Alaska resident who applied in person at Dillingham (RM583: 15 Jul–31 Aug, RM585: 25 Oct–31 Dec).

Board of Game Actions and Emergency Orders. Responding to an agenda change request and proposal submitted by the Bristol Bay Native Association, in October 2002 the Board of Game established a 2-week registration moose hunt for residents only in 17A, which may be announced between 1 December and 31 January. This season was not announced for winter 2002–2003 because of insufficient snow cover to allow travel.

Hunter Harvest. Because of an almost 4-fold increase in hunters afield since 1983 (1983/84–293; 2001/02–1175), reported moose harvests in Unit 17 have more than tripled (1983/84–127; 1999/2000–425). The reported harvest in the past 5 years in 17B has ranged from 168 to 226, with an annual average harvest of 185 moose. In Unit 17C the 5-year mean annual harvest was 188, with a range of 136 to 226 moose (Table 1).

Hunters continued to harvest moose with large antlers throughout this reporting period. During each of the last 7 seasons, more than 46% of the reported harvest has consisted of moose with antler spreads of 50" or greater. The largest antlers reported for each of these seasons have exceeded 69" (Table 2).

General Hunt. The general moose hunt in 17B and 17C is of shorter duration and with more restrictive bag limits than the registration hunts. Greater numbers of nonlocal Alaska residents and nonresidents hunt moose during this hunt than local (Unit 17) Alaska residents (Table 3). Subunit 17A has not had an open general moose hunting season since 1980–81. The reported harvest in the past 5 years for the general moose season in 17B has ranged from 96 to 165, with a mean annual harvest of 133 moose (Table 4). In 17C, the 5-year mean annual harvest for the general hunt has been 23 moose, with a range of 19 to 28 (Table 5).

Permit Hunts. Longer seasons and more liberal bag limits have enticed many resident hunters to participate in the registration hunts (RM573, RM583, and RM585). In fall 2001, 870 permits were issued for Unit 17 registration moose hunts, and 707 hunters reported they hunted, killing 250 moose. In fall 2002, 834 permits were issued for Unit 17 registration moose hunts, and 676 hunters reported hunting, killing 284 moose. Each year approximately 20% of those receiving registration moose hunting permits for Unit 17 reported that they did not hunt (Tables 6, 7, 8, 9).

During the 2001 hunting season in 17A, 47 hunters reported killing 7 moose; the following season, 2002, 36 hunters reported killing 8 moose (Table 6). In 2001, 814 registration hunt permits were issued for Subunits 17B&C, with 655 hunters reporting that they hunted and 243 moose killed. In 2002, 794 registration hunt permits were issued for 17B&C, with 640 hunters reporting that they hunted and 276 moose killed (Tables 7 and 8).

Hunter Residency and Success. The mean number of moose hunters participating in the general moose hunting season in Unit 17 during the past 5 years was 503, an increase from the previous reporting period (Woolington 2002). Participation by resident hunters in the general hunt has declined because of increased interest in the registration hunt. Nonresident participation has generally increased despite more restrictive regulations. Unitwide success during the general hunt ranged from 25 to 36% during the past 5 years, with a mean annual success rate of 31%. In regulatory years 1998–99 through 2002–03, nonresidents accounted for 66% of reporting hunters, residents of Unit 17 accounted for 6%, and other residents of Alaska made up 26% of the total number of hunters in the general hunt (Table 3).

The mean number of moose hunters participating in registration moose hunts in Unit 17 during the past 5 years was 618, a 16% increase from the previous reporting period (Woolington 2002). Success during the registration hunts in Unit 17 ranged from 33 to 46% during the past 5 years, with a mean annual hunter success rate of 40%. Residents of Unit 17

composed 80%, and other residents of Alaska made up 20% of hunters in the registration hunts from regulatory years 1998–99 through 2002–03 (Table 9).

Harvest Chronology. Because of changes in seasons and weather, chronology data did not indicate consistent patterns (Table 10 and 11). Unit residents were the main participants in the August and December seasons. These seasons were originally established to provide local residents an opportunity to harvest moose that were not rutting and discourage the illegal killing of female moose during closed seasons.

Transport Methods. Aircraft were the primary means of access for moose hunters in the general hunt in Unit 17 (5-yr mean = 66%, Table 12). Most participants in the registration hunt used boats for access (5-yr mean = 78%, Table 13). In 1990–91, use of off-road vehicles during the fall, including 3- and 4-wheelers, became prohibited modes of transportation for big game hunters in Unit 17B.

OTHER MORTALITY

Observations of predation by wolves and bears occurred regularly throughout this reporting period. Reports from local resident and nonlocal hunters suggest wolf numbers appeared to be increasing unitwide, and brown bears are common. Snow depths throughout the unit were moderate during the winters of this reporting period, and there were no reports of excessive winter mortality. Moose were apparently able to find abundant forage on winter ranges in riparian areas.

Two moose were killed by a motor vehicles on the Aleknagik Lake Road near Dillingham during this reporting period. The meat was salvaged for human consumption.

Illegal harvest of moose in Unit 17 was probably more of a problem in the past than during recent years. Unit residents used to actively pursue moose with snowmachines during the winter and spring when both male and female moose were taken. Considerable efforts by both state and federal management agencies to work with local communities to see the benefits of reducing illegal moose kills have resulted in changing attitudes. It appears that illegal harvests have decreased dramatically in the past 10 years. There has also been a significant decline in the number of female moose taken. It is now common to see moose near local villages throughout the winters.

HABITAT

ASSESSMENT

Aderman (1999) established 7 intensive mapping areas in Subunit 17A, based on computer-aided analysis of Landsat photos. He visited 104 sites for ground-truthing in July 1998. Information collected included dominant vegetation species, slope, aspect, and drainage. Aderman (1999) estimated a minimum of 560 mi² of optimal moose winter habitat and another 520 mi² of secondary moose winter habitat in 17A.

No formal habitat-monitoring programs were conducted in the remainder of Unit 17. Moose winter ranges along the Nushagak and Mulchatna Rivers, and along the lower reaches of the major tributaries to those rivers, are probably in good condition. Although there is evidence of heavy browsing in some areas, willow stands on gravel bars are abundant and include a good

mix of brush heights. Winter range conditions in the middle and upper reaches of the tributaries have not been assessed, but are probably not as productive.

ENHANCEMENT

No habitat enhancement activities have been documented in Unit 17. Because of the relative inaccessibility of most of the unit and the occurrence of natural habitat change, human-caused habitat enhancement activity is not practical or necessary.

Lightning-caused wildfires are not uncommon in the unit, particularly in Subunit 17B. During this reporting period, there were no large wildfires.

In most years the most important natural force responsible for enhancing moose habitat was the scouring of gravel bars and low-lying riparian areas by ice and water during spring thaw. This was especially true for the Nushagak and Mulchatna Rivers and the lower reaches of the major tributaries to those rivers.

NON-REGULATORY MANAGEMENT PROBLEMS

Dramatic increases in the number of caribou in the Mulchatna herd through the mid 1990s impacted the moose population in this unit, though there was little direct competition between these ungulates. Short-term impacts of large caribou populations include decreased illegal moose harvest by local residents and increased hunting pressure by other residents and nonresidents interested in combination hunts for moose and caribou. The most significant long-term impact on moose may be the response of predator populations to abundant prey resources. Wolf numbers appeared to increase in the unit during this reporting period. There were few instances of wolves following the caribou herd, so when the herd moved out of a pack's territory, moose became the primary source of meat for wolves. The same prey shift can be expected should the caribou herd crash.

CONCLUSIONS AND RECOMMENDATIONS

Predation by wolves, bears, and reported harvests of moose continued to increase in recent years. Good browse conditions and a continuing series of average winters resulted in stable-to-increasing moose populations in Subunits 17A and 17C during this reporting period. The moose population exceeded the minimum goal in 17A and continued to increase. The first reliable population estimate for all of 17B was achieved during this reporting period. Moose numbers in 17B are probably in decline as evidenced by the poor calf recruitment. Although objective habitat evaluations were lacking for most of the unit, it appeared that browse quality and quantity were sufficient to support the population on most of the winter ranges.

Fall trend counts were notoriously unreliable in providing consistent data on moose populations in Unit 17. Suitable survey conditions, including complete snow coverage, light winds, and moose movements onto winter range, rarely occur before antler drop. Regular population estimation surveys of portions of the unit during late winter provide the best moose population information. Unfortunately, they do not provide reliable information on sex or age composition.

Moose hunting activity and harvest have increased in Unit 17 during the past decade. The increased number of caribou in the area has contributed to more nonlocal hunters in the Nushagak River and Wood River drainages. Hunting methods and harvest chronology have remained consistent in recent years, so the increased harvest is indicative of increased effort.

The moose population in 17A has increased dramatically in recent years. We worked with local residents and staff from TNWR and continued work on a draft moose management guideline that established an objective of 1100–1750 moose in the unit. We also continued work on a cooperative moose research project with TNWR to 1) document population trends, 2) evaluate the moose habitat in the unit and estimate carrying capacity, and 3) develop appropriate management goals and regulatory proposals. It is critical that these cooperative efforts be coupled with continued efforts to inform the local public of the continued advantages of reducing illegal harvest of moose in the unit.

The Board of Game had considered impacts of liberalized caribou seasons on the Unit 17 moose population and adjusted the moose season for 1993–94. The board adjusted it again in 1997. The board and the department will need to continue managing these 2 ungulate populations and attempt to monitor predator populations.

Recommended management actions for the next few years include the following:

- Conduct a population estimation survey each winter on a rotating basis of subunits;
- Finalize the moose management plan for Subunit 17A in cooperation with Togiak National Wildlife Refuge, local advisory committees, and local citizen groups;
- Continue to manage Unit 17 moose populations conservatively as long as large numbers of hunters are attracted to the area in pursuit of Mulchatna caribou;
- Continue to seek cost-effective and accurate methods to obtain bull:cow ratios within the unit.

LITERATURE CITED

- ADERMAN, A., L. VAN DAELE, AND M. HINKES. 1995. Estimated moose population size in the Togiak River drainage (Unit 17A) and adjacent Wood River Mountains (western unit 17C), southwest Alaska, 1995. Togiak NWR & Alaska Department of Fish and Game. Dillingham, Alaska USA.
- ADERMAN, A., M. HINKES, AND J. WOOLINGTON. 1999. Population identity and movements of moose in the Togiak, Kulukak, and Goodnews River drainages, southwest Alaska. March 1998–April 1999. Progress Report 99–01. Togiak NWR & Alaska Department of Fish and Game. Dillingham, Alaska USA.
- _____, _____, AND _____. 2000. Population identity and movements of moose in the Togiak, Kulukak, and Goodnews River drainages, southwest Alaska. March 1998–April 2000. Progress Report 00–01. Togiak NWR & Alaska Department of Fish and Game. Dillingham, Alaska USA.

- ADERMAN, A. AND J. WOOLINGTON. 2003. Population identity and movements of moose in the Togiak, Kulukak, and Goodnews River drainages, southwest Alaska. March 1998–April 2002. Progress Report 03–01. Togiak NWR & Alaska Department of Fish and Game. Dillingham, Alaska USA.
- FARO, J.B. 1973. Game Management Unit 17 moose survey-inventory progress report. Pages 117–119 *in* D.E. McKnight, editor. Annual report of survey-inventory activities. Part I. Moose, Deer and Elk. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration Progress Report. Project W-17-4, Job 1, 2, & 13. Juneau, Alaska USA.
- JEMISON, L. 1994. Distribution, movements, reproduction, and survival of radiocollared moose, southwest Alaska. Togiak NWR & Alaska Department of Fish and Game. Dillingham, Alaska USA.
- TAYLOR, K.P. 1988. Game Management Unit 17 moose survey-inventory progress report. Pages 87–89 *in* S. Morgan, editor. Annual report of survey-inventory activities. Part VIII. Moose. Vol. XVIII. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Progress Report. Grant W-22-6, Job 1.0. Juneau, Alaska USA.
- . 1990. Game Management Unit 17 moose survey-inventory progress report. Pages 177–185 *in* S. Morgan, editor. Annual report of survey-inventory activities. Part VIII. Moose. Vol. XX. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration Progress Report. Grant W-23-2, Study 1.0. Juneau, Alaska USA.
- VAN DAELE, L.J. 1995. Mulchatna caribou survey-inventory management report. Pages 23–36 *in* M.V. Hicks, editor. Annual report of survey-inventory activities. Caribou. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Grants W-24-1 and W-24-2. Study 3.0. Juneau, Alaska USA.
- WOOLINGTON, J.D. 2002. Game Management Unit 17 moose management report. Pages 250–272 *in* C. Healy, editor. Moose management report of survey-inventory activities 1 July 1999–30 June 2001. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska.

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Table 1 Reported moose harvest data for all hunts in Unit 17, 1964/65–2002/03

Regulatory Year	Reported Harvest	Hunters afield	Success rate	Unit ^a			
				17A	17B	17C	Unk
1964–65	32	---	---	---	---	---	---
1965–66	42	---	---	---	---	---	---
1966–67	26	90	29%	---	---	---	---
1967–68	38	77	49%	---	---	---	---
1968–69	46	66	70%	---	---	---	---
1969–70	15	31	48%	---	---	---	---
1970–71	25	35	71%	---	---	---	---
1971–72	37	63	59%	---	---	---	---
1972–73	38	74	51%	---	---	---	---
1973–74	42	93	45%	---	---	---	---
1974–75	69	119	58%	---	---	---	---
1975–76	115	207	56%	---	---	---	---
1976–77	49	168	29%	---	---	---	---
1977–78	54	113	48%	---	---	---	---
1978–79	65	160	41%	---	---	---	---
1979–80	33	68	49%	---	---	---	---
1980–81	89	212	42%	---	---	---	---
1981–82	76	209	36%	---	---	---	---
1982–83	49	149	33%	---	---	---	---
1983–84	127	293	43%	0	72	48	0
1984–85	158	344	46%	0	86	70	0
1985–86	148	401	37%	0	94	52	0
1986–87	202	486	42%	0	122	73	0
1987–88	207	499	42%	0	152	42	0
1988–89	187	457	41%	0	157	28	0
1989–90	175	438	40%	0	122	48	0
1990–91	225	489	46%	0	178	44	0
1991–92	268	590	45%	0	172	85	0
1992–93	263	705	47%	0	160	90	13
1993–94	249	705	35%	1	150	78	20
1994–95	296	800	37%	0	167	94	69
1995–96	336	881	38%	0	192	109	35
1996–97	373	913	41%	0	207	113	53
1997–98	347	956 ^b	36%	15	168	126	38
1998–99	389	1048 ^b	37%	10	168	171	40
1999–2000	425	1116 ^b	38%	10	170	192	53
2000–01	373	1112 ^b	34%	10	226	136	1
2001–02	419	1175 ^b	37%	7	182	226	4
2002–03	404	1147 ^b	35%	8	179	214	3

^a Harvest data not broken down by unit before 1983–84.^b Included hunters who registered for both fall and winter registration hunts.

Table 2 Unit 17 moose antler sizes (percent) in the reported harvest, 1992/93–2002/03

Regulatory Year	Antler size			Largest antlers
	<30"	30–50"	>50"	
1992–93	6	36	57	80"
1993–94	3	30	68	73"
1994–95	9	29	62	73"
1995–96	7	35	57	78"
1996–97	9	26	65	75"
1997–98	6	36	57	73"
1998–99	9	35	56	74"
1999–2000	7	37	56	71"
2000–01	8	27	65	80"
2001–02	19	28	53	72"
2002–03	20	35	46	69"

Table 3 Unit 17 moose hunter^a residency and success, 1992/93–2002/03

Regulatory Year	Successful				Unsuccessful				Total hunters
	Local Resident	Nonlocal resident	Nonresident	Total (%)	Local resident	Nonlocal Resident	Nonresident	Total(%)	
1992–93	61	79	64	212 (41) ^b	65	114	124 ^b	310 (59) ^b	522
1993–94	21	28	93	144 (33) ^c	27	117	142 ^c	292 (67) ^c	436
1994–95	22	41	91	161 (33) ^d	24	117	180 ^d	329 (67) ^d	490
1995–96	23	30	115	171 (35) ^e	28	103	177 ^e	314 (65) ^e	485
1996–97	16	35	144	196 (40) ^f	33	82	174 ^f	291 (60) ^f	487
1997–98	13	33	100	150 (35) ^g	29	79	161	277 (65) ^g	427
1998–99	15	34	120	169 (32)	27	111	220	359 (68) ^h	528
1999–2000	16	26	99	146 (29) ⁱ	20	91	235	358 (71) ⁱ	504
2000–01	4	41	139	184 (34)	18	98	236	353 (66) ^j	537
2001–02	11	27	125	169 (36) ^k	14	97	191	302 (64) ^k	473
2002–03	12	25	77	120 (25) ^l	19	115	217	351 (75)	741

^a Excludes hunters in permit hunts.

^b Includes 8 successful and 7 unsuccessful hunters of unknown residency.

^c Includes 2 successful and 6 unsuccessful hunters of unknown residency.

^d Includes 7 successful and 8 unsuccessful hunters of unknown residency.

^e Includes 3 successful and 6 unsuccessful hunters of unknown residency.

^f Includes 1 successful and 2 unsuccessful hunters of unknown residency.

^g Includes 4 successful and 8 unsuccessful hunters of unknown residency.

^h Includes 1 unsuccessful hunter of unknown residency.

ⁱ Includes 5 successful and 12 unsuccessful hunters of unknown residency.

^j Includes 1 unsuccessful hunter of unknown residency.

^k Includes 6 successful and 2 unsuccessful hunters of unknown residency.

^l Includes 6 successful hunters of unknown residency.

Table 4 Unit 17B reported moose harvest^a and accidental death, 1992/93–2002/03

Regulatory Year	Hunter Harvest							Accidental death	Grand total
	Reported				Estimated ^b				
	M (%)	F (%)	Unk.	Total	Unreported	Illegal	Total		
1992–93	152 (100)	0	0	152	0	0	0	0	152
1993–94	125 (100)	0	1	126	0	0	0	0	126
1994–95	132 (100)	0	0	132	0	0	0	0	132
1995–96	148 (100)	0	0	148	0	0	0	0	148
1996–97	171 (100)	0	0	171	0	0	0	0	171
1997–98	127 (100)	0	0	127	0	0	0	0	127
1998–99	139 (100)	0	0	139	0	0	0	0	139
1999–2000	122 (100)	0	0	122	0	0	0	0	122
2000–01	165 (100)	0	0	165	0	0	0	0	165
2001–02	141 (100)	0	0	141	0	0	0	0	141
2002–03	96 (100)	0	0	96	0	0	0	0	96

^a Excludes permit hunt harvest.

^b No estimates of unreported/illegal harvests have been made for this unit.

Table 5 Unit 17C reported moose harvest^a and accidental death, 1992/93–2002/03

Regulatory Year	Hunter Harvest							Accidental death	Grand total
	Reported				Estimated ^b				
	M (%)	F (%)	Unk.	Total	Unreported	Illegal	Total		
1992–93	56 (100)	0	0	56 ^c	0	0	0	0	56
1993–94	18 (100)	0	0	18	0	0	0	0	18
1994–95	28 (100)	0	0	28 ^d	0	0	0	1 ^e	29
1995–96	32 (100)	0	0	22 ^f	0	0	0	0	22
1996–97	23 (100)	0	0	23 ^g	0	0	0	2 ^h	25
1997–98	21 (100)	0	0	21 ⁱ	0	0	0	0	21
1998–99	27 (100)	0	0	27 ^j	0	0	0	1	28
1999–2000	23 (100)	0	0	23 ^k	0	0	0	0	23
2000–01	18 (100)	0	0	18 ^l	0	0	0	1	19
2001–02	26 (100)	0	0	26 ^m	0	0	0	2	28
2002–03	21 (100)	0	0	21 ⁿ	0	0	0	0	21

^a Excludes permit hunt harvest.

^b No estimates of unreported/illegal harvests have been made for this unit.

^c Does not include 3 bulls from an unspecified portion of Unit 17.

^d Does not include 1 bull from an unspecified portion of Unit 17.

^e Includes 1 bull killed in defense of life or property.

^f Does not include 3 bulls from an unspecified portion of Unit 17.

^g Does not include 11 bulls from an unspecified portion of Unit 17.

^h Does not include 1 cow and 1 bull killed in motor vehicle accidents near Dillingham.

ⁱ Does not include 2 bulls from an unspecified portion of Unit 17.

^j Does not include 3 bulls from an unspecified portion of Unit 17.

^k Does not include 1 bull from an unspecified portion of Unit 17.

^l Does not include 1 bull from an unspecified portion of Unit 17.

^m Does not include 2 bulls from an unspecified portion of Unit 17.

ⁿ Does not include 3 bulls from an unspecified portion of Unit 17.

Table 6 Unit 17A reported moose harvest data by permit hunt, 1997/98–2002/03

Hunt No /Area	Regulatory Year	Permits issued ^a	Percent did not hunt	Percent Unsuccessful hunters ^b	Percent Successful hunters ^b	Bulls (%)	Cows (%)	Unk.	Total harvest
573	1997–98	44	11	62	38	15 (100)	0	0	15
	1998–99	48	10	77	23	10 (100)	0	0	10
	1999–2000	57	28	76	24	10 (100)	0	0	10
	2000–01	56	13	80	20	10 (100)	0	0	10
	2001–02	56	16	87	13	7 (100)	0	0	7
	2002–03	40	10	78	22	8 (100)	0	0	8

^a Registration permits were valid for only Unit 17A.

^b Includes only those permittees reporting that they hunted.

Table 7 Unit 17B reported moose harvest data by permit hunt, 1992/93–2002/03

Hunt No /Area	Regulatory Year	Permits issued ^a	Percent did not hunt	Percent unsuccessful hunters ^b	Percent Successful hunters ^b	Bulls (%)	Cows (%)	Unk.	Total harvest
983	1992–93	277	30	63	27	8(100)	0	0	8
583	1993–94	433	19	61	39	23 (100)	0	1	24
	1994–95	438	18	56	44	35 (100)	0	0	35
	1995–96	521	21	56	44	44 (100)	0	0	44
	1996–97	546	20	63	37	36 (100)	0	0	36
583/585	1997–98 ^c	629	25	63	37	41 (100)	0	0	41
	1998–99 ^c	634	25	69	31	29 (100)	0	0	29
	1999–2000	749	24	53	47	48 (100)	0	0	48
	2000–01	685	23	61	39	61 (100)	0	0	61
	2001–02	814	20	72	28	41 (100)	0	0	41
	2002–03	794	19	66	34	83 (100)	0	0	83

^a Registration permit valid for both Units 17B and 17C. Permit data are for both areas combined; harvest data are specific to Unit 17B.

^b Of those permittees that reported hunting in Unit 17B.

^c Includes permits issued and harvest for both fall (20 Aug–15 Sep) and winter (1–31 Dec) permit hunts.

Table 8 Unit 17C reported moose harvest data by permit hunt, 1992/93–2002/03

Hunt No /Area	Regulatory Year	Permits issued ^a	Percent did not hunt	Percent unsuccessful hunters ^b	Percent successful hunters ^b	Bulls (%)	Cows (%)	Unk.	Total harvest
983	1992–93	277 ^b	30	63	27	31 ^d (100)	0	3	34
583	1993–94	433	19	61	39	59 ^e (100)	1	0	60
	1994–95	438	18	56	44	65 ^f (100)	0	1	66
	1995–96	521	21	59	41	87 ^g (100)	0	0	87
	1996–97	546	20	54	46	89 ^h (99)	0	1	90
583/585	1997–98 ^c	629	25	60	40	105 ⁱ (100)	0	0	105
	1998–99 ^c	634	25	48	52	144 ^j (100)	0	0	144
	1999–2000	749	24	49	51	169 ^k (100)	0	0	169
	2000–01	685	23	68	32	118 ^l (100)	0	0	118
	2001–02	814	20	60	40	200 ^m (100)	0	0	200
	2002–03	794	19	51	49	193 (100)	0	0	193

^a Registration permits valid for both Units 17B and 17C. Permit data are for both areas combined, harvest data are specific to Unit 17C.

^b Of those permittees who reported hunting in Unit 17C.

^c Includes permits issued and harvest for both fall (20 Aug–15 Sep) and winter (1–31 Dec) permit hunts.

^d Not included are 8 bulls from an unspecified portion of Unit 17.

^e Not included are 20 bulls from an unspecified portion of Unit 17 and 1 bull from Unit 17A.

^f Not included are 34 bulls from an unspecified portion of Unit 17.

^g Not included are 33 bulls from an unspecified portion of Unit 17 and 1 unreported sex.

^h Not included are 51 bulls from an unspecified portion of Unit 17.

ⁱ Not included are 36 bulls from an unspecified portion of Unit 17.

^j Not included are 37 bulls from an unspecified portion of Unit 17.

^k Not included are 52 bulls from an unspecified portion of Unit 17.

^l Not included are 51 bulls from an unspecified portion of Unit 17.

^m Not included are 2 bulls from an unspecified portion of Unit 17.

Table 9 Unit 17 moose hunter residency and success^a by permit hunt, 1992/93–2002/03

Regulatory Year	Successful				Unsuccessful				Total hunters
	Local Resident	Nonlocal resident	Nonresident	Total (%)	Local resident	Nonlocal resident	Nonresident	Total(%)	
1992–93	43	7	0	50 (27)	122	11	0	133 (73)	183
1993–94	84	21	0	105 (39)	130	33	0	164 (61)	269 ^c
1994–95	106	29	0	135 (44)	128	45	0	175 (56)	310 ^d
1995–96	117	48	0	165 (42)	131	100	0	231 (58)	396
1996–97	117	60	0	177 (42)	157	92	0	249 (58)	426
1997–98	164	33	0	197 (37)	272	60	0	332 (63)	529
1998–99	183	37	0	220 (42)	251	54	0	305 (58)	525
1999–2000	221	58	0	279 (46)	262	71	0	333 (54)	612
2000–01	144	45	0	189 (33)	304	82	0	386 (67)	575
2001–02	193	57	0	250 (36)	370	82	0	452 (64)	702
2002–03	228	56	0	284 (42)	323	69	0	392 (58)	676

^a Includes only permittees who reported hunting.

^b Unit 17 residents.

^c Includes 0 successful and 1 unsuccessful hunter of unknown residency.

^d Includes 0 successful and 2 unsuccessful hunters of unknown residency.

Table 10 Unit 17 reported moose harvest^a chronology percent by month, 1992/93–2002/03

Regulatory Year	Harvest periods									<i>n</i> ^b
	Aug 10–20	Aug 21–31	Sep 1–10	Sep 11–20	Sep 21–30	Dec 1–10	Dec 11–20	Dec 21–31	Unk.	
1992–93 ^c	0	3	44	41	0	2	2	4	3	212
1993–94 ^d	1	2	54	35	0	0	1	1	6	144
1994–95 ^d	1	3	47	37	3	1	2	3	5	161
1995–96 ^d	1	2	55	32	0	0	1	1	9	171
1996–97 ^d	1	2	63	27	0	1	0	2	6	196
1997–98 ^d	0	1	55	36	0	1	1	1	5	150
1998–99 ^d	0	2	60	35	0	0	0	0	2	169
1999–2000	0	3	51	42	0	2	0	1	1	146
2000–01	0	0	55	10	0	0	0	0	4	184
2001–02	0	3	57	38	0	1	1	0	1	169
2002–03	0	2	55	38	0	0	1	0	3	120

^a Excludes permit hunt harvest.

^b Reported harvest

^c General season dates: Unit 17B (upstream) – 1–20 Sep
Unit 17B (remainder) - Residents: 1–20 Sep, 1–31 Dec
Nonresidents: 5–15 Sep
Unit 17C (Iowithla, etc.) - Residents: 1–15 Sep
Unit 17C (remainder) - Residents: 1–15 Sep, 1–31 Dec

^d General season dates Unit 17B – 1–15 Sep
Unit 17C - Residents: 1–15 Sep

Table 11 Unit 17 reported moose harvest chronology for permit hunts, percent by month, 1992/93–2002/03

Regulatory Year	Harvest periods									<i>n</i> ^a
	Aug 10–20	Aug 21–31	Sep 1–10	Sep 11–20	Sep 21–30	Dec 1–10	Dec 11–20	Dec 21–31	Unk.	
1992–93 ^b	20	72	2	0	0	0	0	0	6	50
1993–94 ^c	9	40	19	10	2	3	6	5	8	105
1994–95 ^c	7	30	29	10	1	2	7	8	6	135
1995–96 ^c	15	33	26	14	1	2	1	4	6	165
1996–97 ^c	7	33	23	20	1	2	5	3	5	177
1997–98 ^d	6	35	16	21	0	2	4	11	5	197
1998–99 ^d	10	44	22	14	0	1	1	6	2	220
1999–2000	13	44	16	13	0	1	4	4	6	279
2000–01	17	32	24	19	0	2	1	1	5	189
2001–02	11	46	21	10	0	2	2	7	1	250
2002–03	12	41	20	15	0	6	1	1	3	284

^a Reported harvest

^b Registration permits valid for 20–31 Aug.

^c Registration permits valid for any bull, 20 Aug–15 Sep and 1–31 Dec.

^d Registration permits valid for any bull; Unit 17A, 25 Aug–20 Sep, Unit 17B and 17C, 20 Aug–15 Sep and 1–31 Dec.

Table 12 Unit 17 reported moose harvest^a percent by transport method, 1992/93–2002/03

Regulatory Year	Percent of harvest								Total moose
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Unknown	
1992–93	64	0	29	0	2	0	1	3	212
1993–94	71	0	26	0	9	0	0	1	144
1994–95	71	0	22	0	2	0	1	3	161
1995–96	64	0	33	1	1	0	1	1	171
1996–97	68	0	29	0	2	0	1	1	196
1997–98	65	0	30	1	3	0	1	0	150
1998–99	67	0	32	0	1	1	0	1	169
1999–2000	61	0	36	0	3	0	0	0	146
2000–01	75	0	23	0	0	0	0	2	184
2001–02	64	0	34	1	0	0	0	1	169
2002–03	61	0	38	1	0	0	0	1	120

^a Excludes permit hunt harvest.

Table 13 Unit 17 reported moose harvest by permit hunt, percent by transport method, 1992/93–2002/2003

Regulatory Year	Percent of harvest								Total moose
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Unknown	
1992–93	9	0	83	1	0	1	1	5	50
1993–94	15	0	73	0	6	0	4	3	105
1994–95	18	0	59	0	12	0	3	8	135
1995–96	25	0	68	0	4	0	1	2	165
1996–97	26	0	63	0	6	0	2	3	177
1997–98	8	1	73	0	16	0	1	2	197
1998–99	5	0	81	3	6	0	0	5	220
1999–2000	11	0	74	1	9	0	2	2	279
2000–01	13	0	78	1	3	0	1	4	189
2001–02	10	0	74	1	10	0	1	4	250
2002–03	12	0	82	1	1	1	2	2	284